Cement MILL EDITION of

Concrete

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JULY, 1934

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Chicago, Illinois

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◆

AT last the highway construction industry knows where it stands.

¶ No longer does this great branch of construction activity need to live from hand to mouth, wondering each year whether the next year will see highway programs continued or dropped.

¶ With a federal fund of 532 million dollars appropriated for highway construction up to July 1, 1937, and with an additional sum of 350 millions in sight in the form of gasoline tax funds, the road-building industry can proceed on the basis that close to 900 million dollars will be expended during the next three years.

¶ The federal appropriation, as detailed in the Cartwright bill signed by the President on June 18, provides 200 millions as an outright grant to the states; 72 millions for roads in national parks; and other sums to be matched by the states on the regular federal aid basis.

¶ The way is now cleared for highway construction to GO AHEAD!

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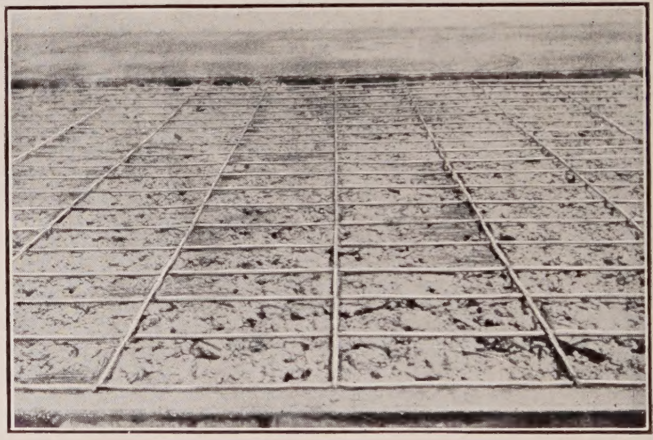

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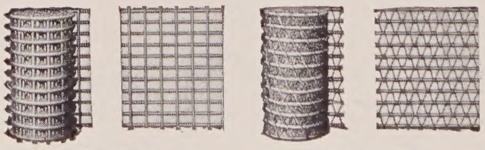

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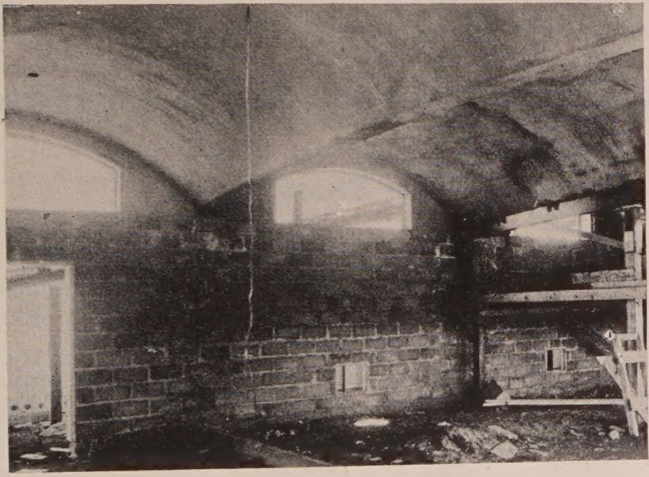
VOL. XLII, NO. 7 **Concrete** JULY, 1934

Reinforced Concrete Shell Roof Over Unobstructed Dairy Floor

World's Fair Exhibit Building Shows First Use of New Construction Type on Modern Fireproof Dairy Barn—Walls Are Concrete Masonry

FOR the first time in this country the Zeiss-Dywidag system of roof construction is used on a farm building. Brook Hill Farm, Genesee Depot, Wis., in cooperation with Starline, Inc., of Harvard, Ill., use this roof construction on the stable portion of the $75,000 exhibition building located at 33rd Street and Lief Erickson Drive at Chicago's World's Fair. A herd of 30 pure bred Wisconsin cows, housed in the stable, will produce certified Vitamin D milk which the public will see as it passes from cow to bottle.



Zeiss-Dywidag system of reinforced concrete shell roof construction leaves floor unobstructed in World's Fair dairy barn

Floor Space Unobstructed

The Zeiss-Dywidag system originated in Germany and has been used extensively in Europe and South America, for roofing structures where a large area of unobstructed floor space is required. The economy, fire-safety and practicability of the construction already demonstrated led to its adoption for the barn of the Brook Hill Farm exhibit.

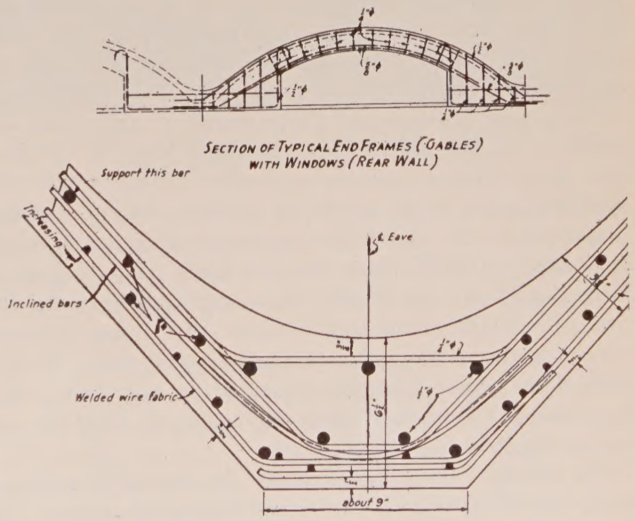
The outside dimensions of the barn are 36 by 72 ft. Concrete masonry walls support the roof, which consists of five standard barrels, each 14 by 34 ft. The stiffening diaphragms in the end gables and the beams at the outer edges of the end barrels bring the eaves of the roof flush with the outside of the 12-in. thick hollow walls.

Steel forms were used for the gable diaphragms and the outer edge beams. Steel ribs supported the barrel forms. The steel units were standardized so they may be used repeatedly on similar structures.

Construction of Form Work

The arched steel ribs were tied against spreading by tension rods made adjustable by turn buckles. They were spaced 3 ft. 6 in. apart, and were supported by curved steel beams running lengthwise of the barrels. The curved beams were required because the roof was given a double curvature to increase the clearance over the center aisle through the barn. The double curvature is not essential to the action of the roof; and this job, as far as known, is the first application of double curvature to a barrel shell roof.

Over the steel ribs, 1-in. by 6-in. sheeting lumber spaced about 4 in. apart was laid to support 4-ft. wide plywood panels. By using plywood a smooth under-surface was obtained, and the forms were quickly erected, because very little cutting and fittings were required.



Detail of roof construction system

Forms for only three barrels were constructed. After the concrete had hardened sufficiently to permit removal of the forms, two sets were shifted to the position of the remaining two barrels.

Placing and tamping concrete on shells, or barrels, on roof of dairy barn. Concrete of stiff consistency was spread with shovels, then screeded, then vibrated into place

The reinforcement for the barrels proper is relatively light. Bars of ¼, ⅜ and ½-in. size were distributed in accordance with the intensity of the tensile stresses. The thickness of the barrels is 3 in. at the crown, and only slightly more at the springings. The 3-in. thickness was in excess of that required for the load and span, but was provided to give the roof added insulating value. Ordinarily, cork board or other insulating material will be used on the under-side of the barrels, but this was deemed unnecessary because the building is to be used only during the summer months.

One day after placing the concrete the roof was waterproofed with a coat of a special material. It also served the purpose of sealing the mixing water in the concrete, insuring satisfactory curing. The under-side of the barrels was painted to harmonize with the interior treatment of the whole structure.

For Roofing Buildings of Large Area

Shell vaults offer a solution to the problem of economically roofing buildings of large area with concrete. This advancement in reinforced concrete design substitutes a shell structure subjected only to direct tensile and compressive stresses in place of beams, girders and frames, which must resist bending stresses and are therefore limited as to span length. The thin roof cover, formerly supported on rafters, purlins and heavy trusses, becomes self-supporting.

Roberts and Schaefer Company, engineers, of Chicago, in co-operation with Starline, Inc., designed the barn section of the exhibit. Richard Philipp, Milwaukee, was the architect. The Brook Hill Farm building was erected by the Continental Construction Company, of Chicago.

Separation of Coarse Aggregate Stops Segregation

Illinois Builds Two-Mile Road as Test Case—Same Material, When Separated and Re-combined, Caused No Further Trouble

THE Highway Research Board, in a recent issue of *Highway Research Abstracts*, publishes an abstract of an unpublished report issued by the Bureau of Materials, Illinois Division of Highways, telling of the elimination of trouble with segregation, when the coarse aggregate causing the trouble was separated into two sizes and re-combined in certain definite proportions.

The report explains that all shipments of aggregates are inspected at the source, from which it may be assumed that each carload contains aggregate falling within the specified limits in the matter of grading. In spite of this inspection at the source, the bureau of materials learned, by means of 19,957 sieve analyses made on paving projects, that 13 per cent of the coarse aggregate exceeded the gradation limits of the specification. In the case of structure concrete, 4,905 sieve analyses showed that 33.8 per cent of the coarse aggregate exceeded the specified gradation limits. The crushed stone aggregate was found to segregate slightly more than gravel.

No attempt was made to study the degree of segregation, but it is evident that some segregation occurs on nearly every job, and that on certain jobs it may become so aggravated as to cause serious difficulty in placing and finishing the concrete.

Segregation Prevented on Experimental Road

In order to investigate the possibility of improvement by the use of coarse aggregate shipped in two sizes, arrangements were made for shipping crushed stone coarse aggregate for 2 miles of a 4¾-mile section in two sizes, 2 in. to 1 in., and 1 in. to ¼ in. The coarse aggregate for the other 2¾ miles was the same except that it was shipped in the regular manner. In all other respects the procedure was the same on both sections.

Prior to beginning work on the experimental section some of the divided aggregate was used in completing work on an adjoining project where, on account of coarsely graded fine aggregate and stock pile segregation of coarse aggregate, considerable difficulty was encountered in placing and finishing. When the divided aggregates were used in combinations of 60 to 50 per cent of the larger size to 40 to 50 per cent of the smaller size the difficulty in working and finishing the concrete disappeared. The best results with this coarsely graded fine aggregate were obtained with the 55-45 coarse aggregate combination.

Proportions Recommended

On the experimental project a differently graded fine aggregate was used. The best combination of the two sizes of coarse aggregate was found to be 60 per cent of the large to 40 per cent of the small. The workability of this combination was found to be so much better than that of the regular undivided material that an increase of ten pounds of aggregate per bag of cement could be used without notable difference in the workability and finish of the resulting concrete.

Sieve analyses of samples from various places in the stock piles of separated materials showed that the segregation in these piles was negligible.

Bringing Out the Best Qualities in Colored Concrete Floor

Use Factory-Mixed Colored Cement in Floor of High School Cafeteria — Cement Finishers Selected from Approved List

THE Rufus King High School, in Milwaukee, Wis., just being completed at a cost of $1,225,000, expresses very nearly the ultimate in high school educational and recreational facilities, as well as in the utilities provided.

One of the most interesting of many individual construction features is found in the colored concrete floor in the large cafeteria.

Colors Harmonize

Both in its colorful effect and in point of service this floor is undoubtedly superior to the average terrazzo floor, yet its cost is less than the cost of terrazzo. The bold pattern conforms to the large size of the cafeteria, as shown in the illustration. Excellent color harmony is attained through the selection of dark brown (chocolate) for the broad bands in the lines of columns (both directions); buff for the large diamonds in the panels formed by the chocolate bands; green for the triangular areas outside the diamonds; and jet black for the column and wall bases. The large diamonds are surrounded by a single line of black mosaics, while brass strips are inserted in all dividing lines between color areas.

Next to the beauty and harmony of these colors, their uniformity is most impressive; and it may be said, also, that the workmanship displayed in the character of the finish is a close approach to perfection.

Careful Attention to All Phases

It must not be supposed that the excellent results obtained in this floor are a matter of chance or accident. On the contrary, the closest possible attention was paid to all phases of the work, from the selection of colors to the selection of workmen.

Consider as an instance, the uniformity of the colors. Architects are all too familiar with the streaks and blotches so often obtained when the cement and the mineral colors are mixed on the job. Too much color in one batch, too little in another, together with insufficient mixing, lead inevitably to bad results.

Cement and Colors Mixed at Factory

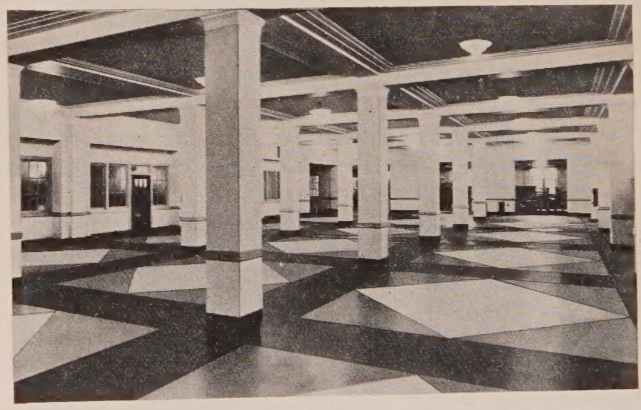
On this high school contract the mineral colors and the cement for the finish coat came to the job as one and the same thing—namely, in the form of *colored cement*. This colored cement is a factory product produced through an intimate mixture of portland cement and mineral colors subjected to regrinding in ball mills. In consequence, the colors are delivered to the job thoroughly premixed. The architect may specify the colors desired, with complete assurance that the specified materials will be used.

The best available workmanship was assured on this contract, because of a selective system adopted by the Board of Education. In line with this policy, contractors are required to select cement finishers from a list of workmen approved by the chief building inspector of the Board, and known by him to be competent finishers.

It is well known from past experience that the most capable cement finishers can not make a satisfactory job with improperly mixed colors. Neither can the most thoroughly mixed colors safely be placed into the hands of incompetent workmen. The materials and methods adopted on this contract eliminated both of these difficulties.

Proportions: Specifications

The colored topping coat for this floor work was mixed in the proportions of 1 part of colored cement, 1 part of torpedo sand, and 2 parts of roofing gravel. Liquid "Anti-Hydro" waterproofing and hardening compound was added to the mixing water to the amount of one quart per bag of cement. This topping mixture was placed to a depth of ¾ in. and was hand finished.



Beautifully colored concrete floor in the cafeteria of the Rufus King High School, Milwaukee

Other details of placing will be seen in the following paragraphs, taken from the general specifications covering this work:

> (a) Colored cement floors shall consist of a layer of cement topping material as specified in Article 19-27,[1] composed of exactly the same proportions of cement, aggregate, and "Anti-Hydro" as therein specified. The amount of water shall be reduced, however, so that the material is in a very dry condition and so that when it is compressed it will not release any moisture or grout. This material shall be leveled off exactly ½ in. below the established finish floor line, and ½ in. colored cement topping shall be applied immediately.
>
> (b) The colored cement topping shall be composed of exactly the same proportions of cement, aggregate,

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[1] An article in another part of the specification.

water and "Anti-Hydro" as specified in Article 19-27,[2] except that the cement shall be "Ricketson's Colored Cement," manufactured by the Ricketson Mineral Color Works, Milwaukee.

In order to obtain uniformity of color, this contractor shall take special care in the mixing of the ingredients. All aggregate shall be measured in a measuring box, struck off at the top, and all water shall be weighed. The colored cement topping shall be of the consistency specified in Article 19-7, section (b).

Finish the surface and protect with "Sisalkraft" paper as specified in Article 19-27. Where floors are laid with alternating colors, previously laid portions shall be protected before applying new colors adjoining.

(c) After all building operations have been completed and all other tradesmen have left the job, this contractor shall thoroughly clean all colored cement work and apply a treatment of "Staybrite" developer. Only first class mechanics shall be entrusted with this work and the whole operation shall be under the charge of a representative of the manufacturer.

The colored cement employed in this work was supplied by the W. H. Pipkorn Company, of Milwaukee, who in turn used mineral colors produced by the Ricketson Mineral Color Works, of the same city. Albert O. Schleisner, chief building inspector for the Board of Education, supervised the work for the Board.

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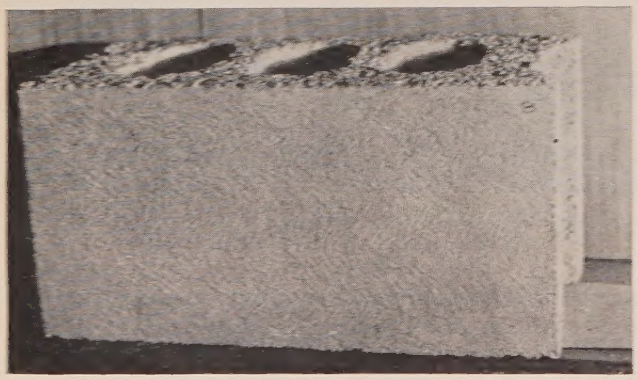
[2] Actual proportions are given in an earlier paragraph.

Texture of Concrete Block with Oscillated Face

Close-Up View Shows Appearance of Waterproofed Surface

OPERATION of oscillating mechanism designed to produce a dense, waterproof surface on concrete building units to be exposed to soil or weather was described in illustrated articles in the June (1934) issue of CONCRETE, pages 15 and 16, and in the March (1933) issue, page 23. An illustration in the last-named article shows a reduced view of an "oscillated" block, in comparison with one that was not given the oscillating treatment.

The illustration here presented gives the reader a fair idea of the texture as well as the density of the face of a cinder concrete unit from the products plant of A. W. Hays, Joliet, Ill.



Close-up showing texture of oscillated face of cinder concrete unit

This effect is produced by having two sides and one end of the block in contact with moving metal plates while the block is being tamped. The side plates are given a combined horizontal and vertical motion, the resultant being a circular motion. The end plate has an up-and-down motion only.

Because of the circular motion of the side plates, occurring while the concrete is under pressure caused by the tamping operation going on at the same time, a coating consisting of a dense paste is brought to the surface. The result is similar to what occurs when concrete is finished with a wood or metal float.

It is not improbable that one of the future developments in the "oscillated" block will be concerned with obtaining variations in texture, possibly by varying the amount or radius of the motion in the plates.

Flat or Elongated Particles Not Always Injurious

Sowers Report Questions Source of Restrictions—Need for More Information on Subject

GEORGE B. Sowers, consulting engineer, Cleveland, Ohio, has issued a report to the Committee on Correlation of Research in Mineral Aggregates, of the Highway Research Board, concerning the effect of thin, flat or elongated particles in coarse aggregate for concrete.

At the request of the committee Mr. Sowers made an examination of the available information on this subject for the purpose of determining, if possible, the reason for the restrictions on such particles in specifications. He found that, although most specifications prohibit injurious amounts of thin, flat or elongated particles, there are no criteria nor methods of determination given.

The slight amount of existing research data does not tend to show any seriously harmful effect upon concrete of thin, flat or elongated particles of sound rock. There is some indication that the original purpose of the specification against such particles was to eliminate shaley or slatey material, which usually occurs in this form in aggregates. Mr. Sowers calls attention to the need for something definite on this matter.—*Highway Research Abstracts*, October, 1933.

Control of Ready-Mixed Concrete

Beginning with the August issue, "Concrete" will publish a series of two articles on plant practice in the control of ready-mixed concrete.

The author of these articles has a background of more than ten years of experience in the design and inspection of concrete structures, and in the design and control of concrete mixtures. During the last four years of this period he served as concrete technician for a large producer of ready-mixed concrete.

Readers will obtain definite and practical information from this series.

County Highway System Dovetailed into State Road Laws

How Illinois County Developed Concrete Paving Program to Take Advantage of State-Aid Refunds—Small Cost to Taxpayers

By **R. M. LOBDELL**
County Superintendent of Highways, Lake County, Illinois

LAKE County (Illinois) has built 136 miles of concrete pavement with bond issue and other funds totaling $3,534,000. Of that sum $2,026,537 either has been or will be returned to the county by the state, as refunds for county-built pavement taken over by the state, and $1,250,000 will be paid for by the county's share of the state gasoline tax, leaving only about $258,000 of county funds which will not be returned by the state. Even this small amount may be wiped out by future refunds.

Lying in a section where peat bogs, muck, and deep black soil were prevalent, Lake County's earth roads were impassable even for horse-drawn vehicles during the spring break-up and after fall rains, prior to 1914. The Illinois state law, passed in 1913, creating a system of state-aid roads and a county superintendent of highways in each county, was the first step in the direction of a co-ordinated system of main roads that could be improved in a substantial manner. Soon after the passage of this legislation Lake County began its hard road program.

The Growth of the Hard Road System

First Step, 1914-16—Lake County's first hard road was built during the period from 1914 to 1916. At that time six miles of concrete pavement was placed. This paving was built in two sections, the first providing a permanent all-year surface for a treacherous section of Grand Avenue between Druce Lake and Lake Villa, while the second provided paving between Waukegan and Gurnee. Part of this pavement was 10 ft. wide, while other portions ranged up to 18 ft. in width. This construction was financed in accordance with the original Illinois State-Aid Law, which provided for an equal sharing of the cost of this type of work between the state and the county, with the provision that the state would pay for the maintenance thereafter. The total cost was approximately $112,000, of which Lake County paid one half.

Second Step, 1917-21—In October, 1917, the voters of Lake County approved a $500,000 bond issue to provide funds for paving the principal north-and-south road and the most important east-and-west road in the county. The favorable vote was stimulated by the fact that the state and federal governments offered to pay two-thirds of the cost of paving one of these roads if Lake County would pay the remaining one-third. Twenty miles of concrete roads were built with this $500,000. A few years later both these roads were included in the $60,000,000 state bond issue system, which resulted in the state refunding to Lake County the money it had paid for their construction.

Third Step, 1920-24—Construction on the $60,000,000 state bond issue system of roads, which was approved by the voters in 1918, was just getting started by 1920. The residents of Lake County, however, having enjoyed the benefits of concrete roads, were not content to wait for the state bond issue program to develop, so in 1920 a second county bond issue was proposed and subsequently approved by the voters, the amount having been $1,000,000.

State legislation had been passed revising the road and bridge laws, thereby encouraging county road construction. These revisions in the law provided that each county in the state should lay out a system of its main roads, to be known as state-aid roads, which might be improved under certain conditions at joint state and county expense. The law provided further that the individual counties could advance the entire cost of making these improvements, in which case the state at some later date would pay its share of the original cost. This law also provided that county roads built of concrete or equally permanent material would be maintained by the state from state funds and without further expense to the county. This second hard road bond issue aimed to take full advantage of the above mentioned revision in the state's road policies, and in accordance therewith 26 miles of concrete pavement were constructed in various parts of the county. The main purpose of this bond issue was to provide hard roads connecting various communities in the county, with one another, and with the state hard roads system, which was growing rapidly.

Fourth Step, 1923-26—As stated previously, Lake County was receiving large sums of money from the state because of having built, in advance, concrete roads which became part of the $60,000,000 state bond issue system.

During the period from 1923 to 1926, some 24 miles of county roads were paved with funds received from this source. This construction was all on state-aid roads, some of which later became part of a $100,000,000 state bond issue system. Thus some of these roads which were constructed with state refunds gave rise to still further refunds that in turn made additional county road paving possible.

Fifth Step, 1926-29—Due to the combined activity of the state and county in building roads, Lake County had in 1926 a network of more than 150 miles of concrete pavement. Certain sections of the county, however, were still without hard roads. Realizing that their property was being taxed to bring good roads to other sections, the taxpayers in these isolated regions made demands for a continuation of the county's program. To this end a $730,000 bond issue was proposed and approved by the voters in April, 1926. During the following years 23 miles of pavement were built with this fund. One-half of the cost of these roads will be paid by the state as funds become available.

Sixth Step, 1930-32—In 1929 the Illinois motor fuel tax law was passed, providing a tax of 3 cents per gallon on motor fuel, one-third of which tax would be refunded to the counties from which it was collected, for use in road construction. Realizing that a bond issue to be retired by gas tax funds would not increase taxation, but would give the motor vehicle operator in all parts of the county the good roads to which he is entitled by virtue of having paid his tax, such a proposal was made and approved by the voters in April, 1930. The sum of $1,250,000 was thus made available for the extension of the county road program. In the two years following, 37 miles of hard roads were built.

Although a state tax is paying for these roads, they were built in accordance with the provisions of the laws governing state aid to counties. Therefore, it is expected that one-half of the cost of these roads will be refunded at a later date to the county. Further extension of the state highway system is to be considered, and refunds may arise from this source. It is logical to assume that the state will continue its policy of refunding 100 per cent of the cost of permanent improvements made by the counties on roads that are later taken into the state highway system.

It is obvious that the road building plan followed by Lake County is giving the taxpayers an excellent system of concrete roads at an extremely low net cost. The bond issue plan took full advantage of the state road laws, which provided free maintenance and state participation in the cost of permanent types of county roads; it created good roads at an early date, thereby saving the motorist time and expense and the county the cost of maintaining improved roads. Each succeeding year sees Lake County maintenance problems becoming smaller, with the result that a greater proportion of the road dollar goes for permanent improvements.

County Is Free of Maintenance Problem

A study of the various steps in the development of the county's highway system leads to the following facts:

1. Lake County is rapidly freeing itself of the maintenance problem which so often plays havoc with county road funds.
2. Increased taxation is preferable to poor roads, as indicated by the attitude of the taxpayers of Lake County who have voted favorably on each of the four hard roads bond issues offered for their approval.
3. It is advantageous to build types of pavement which will keep maintenance costs low so that a large part of future county road income may be available for new construction. It is advantageous to build pavement types which are suitable for state highways, so that the state will refund the construction costs if the roads are placed on the state system.
4. Lake County's bond issue and refund money has been *invested in,* not spent on, roads. These roads are paying dividends daily in service, and since the state guarantees the maintenance and reconstruction where necessary, it is apparent that from the county's viewpoint these roads are permanent and maintenance-free.

Better Control of Concrete a Definite Necessity

British Subscriber Commends Work of Kitts —Absolute Volume Measurements to Become Standard

Editor, CONCRETE:

I should like to take this opportunity to express again my appreciation of your publication CONCRETE. I have been particularly interested in following up the very instructive articles by Mr. Joseph A. Kitts on "Co-ordination of Basic Principles of Concrete Mixtures."

There can be no further advance toward obtaining real uniformity in concrete, so long as the old methods of bulk volume of concrete measurements prevail. I might refer to a paper by Mr. G. T. Carpenter, Assoc. M. Inst. C. E., on "Reinforced Concrete Roadwork," read before the Institution of Civil Engineers. On one of the roads described, great care was exercised in the control of concrete-making. The cement was batched by weight, in 1-cwt. bags; the sand was also batched by weight, the most careful ascertainments of moisture content in the sand having been taken; and the aggregates were tested daily for voids, fineness moduli, organic impurities, silt, and water content. The water-cement ratios were controlled, and for one particular class of concrete the ratio was held at 51 per cent, not more than 3 per cent variation occurring. A small field laboratory was established, and an assistant was constantly employed on this work.

In spite of the careful procedure just described, the mean variation from the average in compression tests of cubes and cylinders, was from 10 to 12 per cent—the author expressing himself as having been somewhat disappointed, although these variations are much less than those usually found in concrete work.

I think some practical method of control of grading and proportioning, as indicated by Mr. Kitts in the case of the Talbot-Richart grading equations, might have reduced these differences in strength. Absolute volume measurements will be established as the standard method, sooner or later.

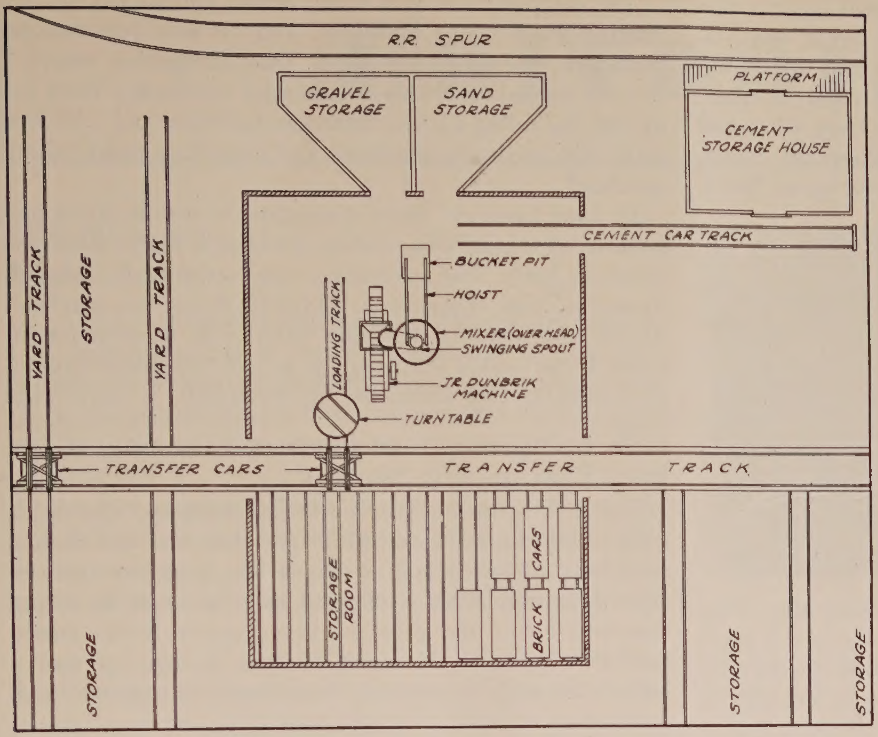
NORMAN A. GRANDAGE, A.M.I. Struct. E.
Sales Manager,
The Contract & Works Supply Co.

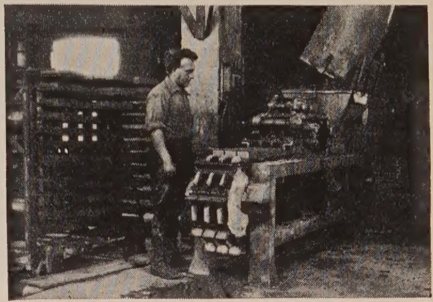
Marsden,
Near Huddersfield,
England
April 21, 1934

Addresses of Code Authorities

A LIST of "The First 453 NRA Codes" is given in a bulletin dated May, 1934, issued by the National Association of Manufacturers, 11 West 42nd Street, New York City.

Information contained in the bulletin includes an alphabetical list of industries operating under codes, the dates of their approval, the NRA division to which each code is assigned, and the address of each code authority. Single copies of the bulletin will be mailed, without charge, while the supply lasts.





Layout of the modern concrete brick plant here described. Other pictures show the continuous-production brick machine in operation, and the Chevrolet Building, built of concrete brick

Low-Cost Concrete Brick Plants Serve Local Areas

Meet Demand for Color and Texture—Backed by Courage and Sound Judgment—Plants in Carolina Cities Fall Behind in Filling Orders

A NEW industrial order in the form of decentralized manufacturing of building materials is seen in a group of low-cost plants for the production of colored concrete brick and concrete ashlar units, the first of which started operations last November in Lancaster, S. C. Other plants, owned by Thomas W. Belk and a group of Lancaster business men, are in operation in Greenville, S. C., and in Charlotte, Lexington, and Albemarle, N. C.

Contractor Turns to Concrete Brick Manufacture

Thomas W. Belk, head of the Lancaster Brick and Tile Company, was a building contractor until the latter part of 1933. Like many other contractors, he carried on his operations at a reasonable profit—on the average—until about 1931. Then during the several years following, he was continually losing money.

This business of losing money could not go on forever, so Belk set about the job of finding a new kind of activity that would put him back on an earning basis. He had an urgent desire to remain in the building industry, for he knew more about that industry than about any other. He also reasoned that, with building construction practically at a standstill for several years, new construction would be in demand long before business recovery was fully completed. He knew, further, that the building public was interested in better architecture and more color in buildings. The Century of Progress Exposition was in considerable part responsible for this new popular attitude.

Applying Concrete Construction to Smaller Buildings

Then, in addition, that part of the public that is interested in building construction was also interested in new types and new materials of construction. Particularly was this new interest directed toward concrete construction.

Concrete buildings had given an excellent account of themselves in fires, in hurricanes and tornadoes, and in earthquakes. People had been reading about these performances, and they were favorably impressed. Concrete was being used extensively for large buildings of all classes of occupancy—so why not in small buildings such as dwelling houses and small business buildings of the kind needed in a town of the size of Lancaster?

For Color and Texture

Mr. Belk finally came to the conclusion that, so far as his community was concerned, the most practicable way to obtain concrete construction, and colorful construction at the same time, is by means of concrete brick, and perhaps also with larger units that might be laid up in random or coarsed ashlar. With building units of these types there would be less of a departure from what had been in vogue than would be the case with wholly monolithic concrete. Combined with monolithic concrete floors, or slab and precast joist floors, the building would still be concrete. Another advantage was seen in the use of concrete brick and concrete ashlar block, because colors and textures could be selected or matched in advance.

The Lancaster plant and storage yard

Holding Down His Plant Investment

Next, he made a study of the type of machinery best suited to the purpose. He concluded that a low-cost machine of sufficient capacity to supply Lancaster and the territory immediately surrounding the town was what he wanted. He wished to avoid a top-heavy plant investment. He wished also to avoid long shipments from the factory to the construction site, for he realized, along with many others, that too large a proportion of cost of building materials is represented by transportation charges.

Belk drove to Holland, Michigan, not only to visit the plant of the W. E. Dunn Manufacturing Co., where such machines are made, but to see some of them in operation at concrete products plants along the route of his trip.

He returned to Lancaster fully convinced that he had found the right machine—one that would involve small plant investment, yet give him a large output because it was designed for efficient straight-line production similar to the methods followed in the manufacture of automobiles. He placed the whole plan before a few well-known Lancaster business men, and obtained their ready co-operation, with the result that the Lancaster Brick and Tile Company was organized on October 23, 1933. Two weeks later the Lancaster plant was in operation.

Unfilled Orders—a New Experience

The first brick sold were for mantels. From these small orders, which were solicited, this colorful new product became known throughout the town and country. Then it began to appear in the exterior walls of buildings, notably in the Chevrolet Building in Lancaster, where the common concrete brick was used, with the front and side faced with their buff-colored mat-glazed brick. Next came three church jobs, calling for 72,000, 180,000 and 200,000 bricks, respectively. So fast have the orders been coming that in May the Lancaster plant was behind in its orders to the amount of 600,000 bricks.

The company has sold many bricks and blocks for veneering wood frame buildings, and for new foundations, chimneys, and even for steps. One illustration shows a 4-room bungalow, which a Lancaster contractor built for $1,000, including wiring, bathroom facilities, and a kitchen sink. The walls are plastered and there is a wood ceiling overhead.

In some cases the plant is required to match colors and textures of masonry in existing buildings, where additions are to be built. One interesting case was that of a mantel, where the color of the owner's favorite flower was matched. Another problem in matching colors was encountered in a new home for the proprietor of a pool and billiard room, who specified the color of the seven-ball—a dark wine color.

Most Economical in the Wall

Mr. Belk is the authority for the statement that brick masons lay his brick for $1.50 per thousand less than a clay brick. Even though a clay brick plant less than 10 miles from Lancaster is offering its product at $2.00 per thousand below the price of the concrete brick, mason contractors prefer the latter because it lays up into a better wall with less mortar. In a word, the concrete brick is the more economical in the wall.

This 4-room bungalow was built with double and triple-size brick units, the tie being made with double brick, laid on edge. The cost was only $1,000, including plumbing and wiring

The experience of the Lancaster Brick and Tile Company has again demonstrated that courage and sound judgment will produce the seemingly impossible. Thomas W. Belk represents the new type of industrial leadership that is destined to revive the industrial importance of our towns and smaller cities.

Contractors and products manufacturers in all sections of the country, especially in sections that do not produce high quality clay brick, may find it to their interest and profit to make a detailed study of similar possibilities in their own localities.

A Delicate Operation

Philip Weiss of Philadelphia, manufacturer of cast stone, pre-cast concrete and garden furniture, sends in this one:

"John Finn, of 5430 Mascher Street, performed a 'delicate operation' on a dog with four broken legs last week. In four days the dog was entirely restored. What is more, Finn used portland cement as a therapeutic agent. It was a concrete dog!"

EDITORIAL

882 Millions for Highways

A GRAND total of 882 million dollars to be spent over a period of three years—that is the estimated size of the Federal highway construction program made possible by the Cartwright bill approved by Congress on June 9 and signed by the President on June 18.

The bill provides Federal appropriations totaling 532 million dollars, to be expended by July 1, 1937. States are expected to swell this sum by an estimated amount of 350 millions during the same period.

For immediate construction, the sum of 200 million dollars is provided as outright grants to the states, and 24 millions a year for three years, for roads in national parks and on public lands.

Proceeding with a speed that augurs well for the administration of this new fund, Acting Secretary of Agriculture Tugwell, on June 19, apportioned this 200 million dollar item among the 48 states, Hawaii, and the District of Columbia. Following the requirements of the law, the Acting Secretary apportioned seven-eighths of the total authorization on the basis provided by the Federal Highway Act, which prescribes three factors of equal weight based upon the area, population, and rural post-road mileage of the several states and Hawaii. The remaining one-eighth was apportioned according to population.

The money is immediately available for allotment to construction projects on the Federal aid highway system and its extensions into and through cities and on important secondary roads. The law requires that, in the absence of satisfactory reasons to the contrary, not less than 25 per cent of the apportionment to any state must be applied to secondary or feeder roads, including farm-to-market roads, rural free delivery roads, and public school bus roads.

Full credit is extended to Representative Cartwright, who is chairman of the House Committee on Roads, for carrying to a successful conclusion this long fight for additional federal approriations for highway construction.

As explained in this connection in an editorial on the cover page of the April (1934) issue of "Concrete," Representative Cartwright took cognizance of the fact that many states have frittered away their gasoline tax and automobile license funds by diverting the money to uses other than highway construction and maintenance. Knowing the situation, he realized the necessity of having the Federal government carry the burden of highway construction until state diversion laws can be repealed.

Now that the way is cleared and a three-year highway construction program is mapped out, it is the sincere hope of the friends of better roads that the administration of this new and widely-spread-out fund may avoid the heart-breaking delays associated with the 400 million dollar highway construction fund appropriated in 1933. State highway departments having the will to do so may accomplish much toward getting this new fund into circulation.

Committee C-1 Reports on Special Cements

COMMITTEE C-1 on Cement, of the American Society for Testing Materials, has presented an extremely interesting report at the annual meeting of the Society in Atlantic City.

Particularly in its handling of the proposed specification for low-heat cement has the committee acted with wisdom. Recognizing that "special-purpose" cements are on the way, and that sound engineering construction requires them, the committee refused to be carried away by the prevailing enthusiasm in some quarters for a "cement for every purpose."

The A. S. T. M. subcommittee to which the preparation of a specification was assigned recommended —after free and open discussion of the question— that the subject of low-heat cement be referred to various working committees for further study and recommendation. It was, apparently, the feeling of the committee that further research and experimentation are necessary before intelligent action can be taken.

The committee report puts forward the further suggestion that low-heat cement need not necessarily be a portland cement type. Quoting from the report: "While these (proposed) standards refer to special cements of the portland type, it would be well to remember that the committee is cognizant of the fact that very likely the same desired properties may be obtained through the use of cements not wholly of this type, or possibly of an entirely different type."

In line with the statement just quoted, a working committee of Committee C-1 has been collecting data regarding progress in this and other countries in the development and use of cements other than those made wholly from portland cement clinker.

Readers of "Concrete" whose primary interest in cement is that of the user are reasonably familiar with what has been accomplished in the development of low-heat cement for Boulder, Norris and Pine Canyon Dams. They have also read about the blending of silica and portland cement. They may be assured that in the hands of Committee C-1 these problems are being considered from all sides.

PROGRESS—In a Page

Current activities in research, in matters pertaining to concrete and cement, as being carried on or completed by various organized groups.

Test Composite Beams of Concrete and Wood

THE JANUARY (1934) issue of *Highway Research Abstracts* describes tests made in 1933 at George Washington University, Washington, D. C., to determine the efficiency of composite timber-concrete beams. The beams were made of laminations of 2-in. plank of southern yellow pine spiked and bolted together to make a beam 12 in. wide. The upper edges of alternate laminations were raised 2 in. to form longitudinal grooves 2 in. deep and the width of the dressed 2-in. plank. Into the grooves were driven triangular metal plates which mortised into the corners of the raised laminations and into the top of the depressed ones. These plates proved very effective as shear keys. The concrete top portion of the beam was a 1-1½-3 mixture of Incor cement and ¾-in. maximum aggregate. The composite beams were 12 ft. long and approximately 12 in. wide and 11 in. deep, and were tested for deflection and ultimate load. The tests show that the full strength of homogeneous beams or slabs may be developed in properly designed composite beams of wood and concrete. The test beams indicated an ultimate capacity of 4,000 to 5,000 lb. per sq. ft. uniform load over simple beams of 12-ft. span.

International Meeting of Bridge and Structural Engineers

THIS year's session of the permanent committee of the International Association for Bridge and Structural Engineering was held in April at Stresa, the president of the association, Prof. A. Rohn (Zurich), being in the chair. The meetings brought together delegates from 12 countries. The membership of the association is increasing. At present the association has, in round figures, 1,500 individual and collective members, representing 46 countries.

Papers presented at the various sessions included the following on various phases of reinforced concrete:

(1) Practical Calculation of Circular Tank Walls of Reinforced Concrete, by Dr. B. Enyedi, of Budapest.

(2) Resistance and Safeguard Against Shear in Reinforced Concrete Structures, by Dr. Ing. H. Ertl, of Vienna.

(3) Breakdown Test of a Thin Conoidal Vault of Reinforced Concrete, by M. Fauconnier, of Paris.

(4) Methods of the Theory of Plasticity in the Investigation of Statically Indeterminate Supporting Structures of Reinforced Concrete, by Dr. A. Freudenthal, of Prague.

(5) Secondary Stresses due to Stiffness of the Connections of the Bars in Frame-Like Reinforced Concrete Structures and the Limit of Tensile Stresses in Concrete, by J. Ridet, of Paris.

(6) Secondary Stresses in Lattice Girders of Reinforced Concrete, by Dr. Luigi Santarella, of Milan.

(7) Arched Structures. Arched Bridges: Determination of Optima Characteristics. Continuous Arches: Three-Bay Shed with Continuous Vaults Without Tie Rod, by R. Vallette, of Paris.

These papers, and a number of others, are published in a 496-page paper-bound volume (designated as Second Volume) by A. G. Gebr. Leeman & Co., Stockerstrasse 64, Zurich, Switzerland. The head office of the International Association for Bridge and Structural Engineering is at the Swiss Federal Institute of Technology, at Zurich, Switzerland. For non-members of the association the price of this volume is 34.80 Swiss francs.

Causes of Crazing

INVESTIGATIONS conducted by the Building Research Station at Watford (England), established by the Department of Scientific and Industrial Research, to determine the cause of crazing, are reported in *Concrete Builder*, Vol. 8, No. 12, 1933, pages 229 to 230, according to *Building Science Abstracts*.

The investigation and tests have shown that crazing is usually associated with a surface layer of carbonated material due to the reaction of atmospheric carbon dioxide with the free lime present, and decomposition by carbon dioxide of the hydrated calcium silicates and aluminates, with the formation of calcium carbonate and silica and alumina gel.

These reactions cause shrinkage and the formation of a "skin." It is thought that a tendency to crazing may be influenced by variations in the type of skin thus formed. Further investigation is being made of these phenomena. Examination of a number of commercial pigments commonly used in the manufacture of colored concrete products has shown that several contain inert diluents or extenders, such as barium sulphate or calcium carbonate. Mention is also made of a method, developed by the Building Research Station, for testing the permeability of interlocking roofing tiles.

Of More Importance Than Strength

THE February (1933) issue of *Building Science Abstracts* (London) tells of the results of an extensive series of tests carried out in the Municipal Testing Laboratory (*Städtische Prüfungsanstalt für Banstoffe*), Vienna, on ordinary, rapid-hardening, and iron-portland cements, and on low-lime slag cements, show that the quality now obtainable is considerably superior to the requirements of the standard specifications. It is suggested, therefore, that strength tests are no longer of significance to the practical builder, but that greater importance attaches to ensuring such uniform grading of aggregate and control of the water-cement ratio as shall enable full advantage to be taken of the qualities of cement.

Left: Factory-made reinforced concrete precast joists. At the left may be seen the reinforcement for a joist. Right: Two men handle one joist, in a manner similar to wood joists. Speedy erection is one reason why this type of floor is economical

Precast Joists and Monolithic Slab Form Ideal Concrete Floor

Architects and Engineers Urged to Give Wider Recognition to New Floor Construction—Design Table Presented—Type Adapted to Light and Moderate Floor Loads

DURING the past year or more, much has been published about the new light-load reinforced concrete floor construction that consists of a thin reinforced concrete cast-in-place slab supported on precast reinforced concrete joists.

Patents—But No Developments

In one sense this type of floor should not be termed "new." In the March (1933) issue of CONCRETE, page 15, E. W. Dienhart lists a number of patents covering precast concrete joists—patents that date all the way back to 1901. But, as with so many other new ideas, little or nothing was accomplished beyond taking out patents.

In some cases the patentees attempted to sell "rights" to make and use the product, while others attempted to break into manufacturing themselves. The latter, at least, deserved to succeed; but the mental inertia of building construction people was a hurdle that could not be cleared —at that time. It was too much of a departure from the way in which light-load floors were then being built.

In very recent years, however, the precast joist and monolithic slab floor has become a real factor in building construction. The mental inertia which previously blocked progress in this very practical type of floor construction is at last being overcome.

Time for Architects to Act

Most of the magazine articles and advertising literature published on the subject of the precast joist and monolithic slab floor have emphasized the broad opportunities opened up to concrete products manufacturers and concrete contractors. Products manufacturers have been told, quite properly, that a new market was at their door—the market for precast reinforced concrete joists. Contractors have been urged to specialize in this new type of concrete floor construction, which enables them to obtain a low-cost concrete floor that is in fact monolithic, but requires very little form work and involves no construction difficulties.

The time is here now, however, for architects and structural engineers to familiarize themselves with this form of construction, and to make use of it wherever possible. It is, beyond question, the most economical reinforced concrete floor among the wholly self-supporting types.

Floor Is Truly Monolithic

Architects and engineers now have available, in published form, all the data needed to convince them and their clients that a floor of this type is truly monolithic. Tests conducted by Prof. F. N. Menefee at the University of Michigan and reported by him in an article in the March (1934) issue of CONCRETE, pages 5 and 6, supply conclusive evidence that the bond is complete between the precast joist and the cast-in-place slab. Not in a single instance did the construction fail (when tested to failure) at the junction between slabs and joists. This means that

PRECAST REINFORCED CONCRETE JOISTS—STEEL REQUIREMENTS

General details	Allowable unit tensile stress in steel, f_s	Size of bottom (tension) bar in joist. (Deformed bar, intermediate grade steel) — Span in Feet 10	11	12	13	14	15	16	17	18
Joists spaced 20 in. c. to c.	20,000 (A.C.I.)	½″ rd.	½″ rd.	½″ sq.	⅝″ rd.	⅝″ rd.	¾″ rd.	¾″ rd.	¾″ rd.	⅞″ rd.
Slab thickness = 2 in.	18,000	½″ rd.	½″ sq.	½″ sq.	⅝″ rd.	¾″ rd.	¾″ rd.	¾″ rd.	⅞″ rd.	⅞″ rd.
Dead load = 48 lb. per sq. ft.	16,000	½″ rd.	½″ sq.	⅝″ rd.	¾″ rd.	¾″ rd.	¾″ rd.	⅞″ rd.	⅞″ rd.	1″ rd.
Joists spaced 21 to 24 in. c. to c.	20,000 (A.C.I.)	½″ rd.	½″ sq.	⅝″ rd.	⅝″ rd.	¾″ rd.	¾″ rd.	⅞″ rd.	⅞″ rd.	
Slab thickness = 2 in.	18,000	½″ rd.	½″ sq.	⅝″ rd.	¾″ rd.	¾″ rd.	¾″ rd.	⅞″ rd.	⅞″ rd.	
Dead load = 47 lb. per sq. ft.	16,000	½″ sq.	⅝″ rd.	¾″ rd.	¾″ rd.	¾″ rd.	⅞″ rd.	⅞″ rd.	1″ rd.	
Joists spaced 25 to 27 in. c. to c.	20,000 (A.C.I.)	½″ sq.	½″ sq.	⅝″ rd.	¾″ rd.	¾″ rd.	¾″ rd.	⅞″ rd.		
Slab thickness = 2 in.	18,000	½″ sq.	⅝″ rd.	¾″ rd.	¾″ rd.	¾″ rd.	⅞″ rd.	⅞″ rd.		
Dead load = 46 lb. per sq. ft.	16,000	½″ sq.	⅝″ rd.	¾″ rd.	¾″ rd.	⅞″ rd.	⅞″ rd.	1″ rd.		
Joists spaced 28 to 30 in. c. to c.	20,000 (A.C.I.)	½″ sq.	⅝″ rd.	¾″ rd.	¾″ rd.	⅞″ rd.	⅞″ rd.			
Slab thickness = 2½ in.	18,000	⅝″ rd.	¾″ rd.	¾″ rd.	¾″ rd.	⅞″ rd.	⅞″ rd.			
Dead load = 51 lb. per sq. ft.	16,000	⅝″ rd.	¾″ rd.	¾″ rd.	⅞″ rd.	⅞″ rd.	1″ rd.			

Main slab bars (perpendicular to joists) are ¼-in. round, spaced 12 in. center to center; or welded wire fabric of equivalent effective area.

Tie bars (parallel to joists) in slab are ¼-in. round, spaced 18 in. center to center; or welded wire fabric of equivalent effective area.

DESIGN VALUES: Bending moment = wl 2/8; d = 8.38 in.; j = 0.875; f_c' for joist = 3,000 lb. per sq. in.; f_c' for slab = 2,000 lb. per sq. in.

LOADS: Dead loads indicated in the first column include 15 lb. per sq. ft. for plaster and floor finish. Live load is assumed at 40 lb. per sq. ft. Proper allowances must be made for any partitions carried by the floor. Joists must be doubled under partitions, or spaced closer. Joists carrying load-bearing partitions must be designed specially for the loading actually imposed.

BRIDGING: In spans more than 14 ft., provide a solid concrete header between joists at mid-span.

LONGER SPANS: For longer spans than here indicated, special anchorage of the tension steel will be required.

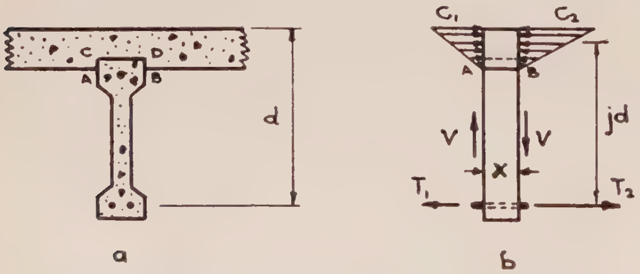
the floor is a true T-beam type and may be calculated and designed on that basis.

Other tests conducted at the laboratory of the Portland Cement Association and reported by R. E. Copeland and P. M. Woodworth in the *Journal* of the American Concrete Institute (March-April, 1934) show results in agreement with the results obtained by Prof. Menefee.

While the greater part of actual construction of this floor type thus far has been confined to residential buildings, architects and engineers who familiarize themselves with its characteristics will readily recognize its application to all types of light-load and moderately light-load buildings.

Application to Remodeling Work

Especially in remodeling work will this type be found practicable, because old wood joist floor construction may be torn out and replaced with this new type of fireproof floor without encountering complications in supports for form work.



The precast joist forms a perfect bond with the cast-in-place slab. The result is a true T-beam

Even where floors must be designed for heavier live loads, the same type of construction may often be employed, especially in remodeling work, when the span is not too great. Joists of somewhat greater depth than commonly used may have to be employed in some cases; but structural designers will know how to design them.

Design Table Developed

The table here presented, for which credit is given to the Portland Cement Association, will supply structural designers with the necessary data where live floor loads fall within the figures on which the table is based. As just suggested, designers can readily prepare additional tables for heavier live loads. Attention is invited in particular to the explanatory footnotes at the bottom of the table, for full information on the conditions of loading and the design values. The *type* of joist assumed is that shown in the line drawing, inasmuch as this type has become quite general in use. It seems to be the most practicable from the standpoints of manufacture and handling.

Many of the patents granted on precast joists have expired, and many others are inapplicable to the present-day form of precast joist and slab construction. In consequence, neither manufacturers nor users have anything to fear from this source. For a further discussion of this point, readers are referred to the article by E. W. Dienhart, mentioned previously as having been published in the March (1933) issue of CONCRETE, pages 15 and 16.

A. S. A. E. Annual Meeting

Low-Cost Concrete Floors for Farm Structures

THE program of the 28th annual meeting of the American Society of Agricultural Engineers, held at the Detroit-Leland Hotel, Detroit, Michigan, June 18 to 20, inclusive, included a paper read before the Farm Structures Division by W. G. Kaiser, manager of the Cement Products Bureau of the Portland Cement Association. His subject was "New Ideas in the Construction of Low-Cost Concrete Floors."

Cements for Low Heat of Hardening and Resistance to Sulphates

Report of Cement Committee Presented to Annual Meeting of A. S. T. M.—Low-Heat Cement Not a Cure-All—Subject Needs More Study

INTEREST among engineering and construction groups in the question of the need for various types of special-use cements was reflected in the lengthy report presented by Committee C-1 on Cement before the thirty-seventh annual meeting of the American Society for Testing Materials held in Atlantic City from June 25 to 29.

Of particular interest was that part of the committee report dealing with low-heat cement and with sulphate-resisting cement. In fact, two new proposed standards covering these two types of cement were presented at the March (1934) meeting of Committee C-1; but after a full discussion of low-heat cements the working committee handling that subject made a recommendation against adopting a standard specification until further study had been made.

Both of the standards discussed at the March meeting—standard specifications for low-heat cement and for sulphate-resisting cement—had reference to special cements of the portland type. The report of Committee C-1 that was presented at the annual meeting, however, emphasized the probability that the same desired properties might be attained through the use of cements not wholly of the portland type; or they might possibly be of an entirely different type. A working committee of Committee C-1 is collecting data on these points.

The interest in cements developing relatively low amounts of heat during hardening has been stimulated through the use of such cements in mass concrete work, particularly in structures such as Boulder Dam, Pine Canyon Dam and Norris Dam. Such cements are characterized by low amounts of tricalcium silicate and tricalcium aluminate, high percentages of dicalcium silicate, and high percentages of tetracalcium alumino-ferrite if the producer chooses to reduce the total amount of silicates through the use of iron oxide as part of the raw-mix. Such cements, the committee report continues to explain, were made during the early part of the present century; first, in Germany, where the Krupps produced their Erz-Zement, and in this country by the American Cement Co., at Norfolk, Va.; the Jamestown Cement Co., at Jamestown, Va.; and the Yankton Cement Co., at Yankton, S. D. At that time they were not suggested for the purposes now indicated, but were proposed either for general use; or if any particular use were stressed, it was that of resistance to SO_3.

Low heat of reaction between the cement and the water is accompanied by low early strength. As measured by the standard tension briquet, the 7-day strength is about one-third less and the 28-day strength about one-fifth less than that developed by standard portland cement. The committee, however, is considering a compression specimen—a 2-in. plastic mortar cube and a compressive strength of 500 and 1,500 lb. per sq. in. at 7 and 28 days, respectively. It has also been suggested that the desired quality of low heat of hydration can be defined by a limit of 7 per cent upon the tricalcium aluminate, and a further requirement that the sum of the percentage of tricalcium silicate and twice the percentage of tricalcium aluminate should not exceed 50 per cent. There are others, however, who feel that the specification should contain actual limits for the heat of hydration at 7 and 28 days, as determined by the difference between the heat of solution of the unhydrated cement and that hydrated for 7 and 28 days in a calorimeter. The fineness as determined by the Wagner turbidimeter has been proposed as not less than 1,500 sq. cm. per gram.

LOW-HEAT CEMENT

The Working Committee on Low-Heat Cements, under the direction of Ernest Ashton, studied available data regarding these cements, particularly those made available by the Bureau of Reclamation and the materials testing laboratory of the University of California.

The committee meeting had much the character of an open hearing at which all in attendance were called upon to ask questions and express opinions. Attention was called to the difficulties on the part of some in making accurate tests for heat of hydration; others reported such difficulties as being no more serious than those met with in performing other physical tests on cement.

The suggested specification of the Portland Cement Association which was recently distributed to members of Committee C-1 provides for limits of composition requirements instead of tests. Some hold to the view that a specification with test requirements is quite novel and that such a proposal should have the most searching investigation. It was believed that the committee should not balk at difficulties with tests but should make further studies to develop test methods which could be shown and accurately applied.

Low-Heat Cement Not a Cure-All

Some of those in attendance who have had extensive experience in the use of low-heat cements called attention to the fact that experience with their use has not been all that was expected. It was pointed out that several other provisions for extraction of heat from large masses of concrete had to be provided in addition to the use of low-heat cement; therefore, it was concluded that low-heat cement is not a cure-all and prospective users should not look upon it as a means of eliminating cracks in structures.

Attention was called to the probability that conditions to be met on important large structures would vary, and the belief was that any one standard specification adopted at this time would not be likely to apply to various projects. It was also pointed out that the Federal Government is the principal user and has available all of the experience and research data on the subject.

The added costs and difficulties in manufacture, storage and distribution were cited, and views were expressed by several that a standard specification, if adopted, would mislead cement users to specify this product for purposes for which it is not applicable.

Further Study Needed

The subcommittee in reporting these controversial points of view submitted findings as follows:

(1) The present demand for low-heat cement exists entirely or nearly so in connection with large projects under various branches of the Federal Government.

(2) Due to the incomplete character of the research, and inadequacy in the methods of test, the several specification requirements must be subjected to further investigation and discussion.

(3) The work now going on, both in research and in use, furnishes the committee with a vast amount of data and experience which may be used as a guide for its further work.

The subcommittee therefore recommended that Committee C-1 refer this subject of low-heat cement to its various working committees for further study and recommendation in accordance with its usual procedure, but it believed that, due to the wide divergence of views now existing among both users and manufacturers regarding proposed specifications, Committee C-1 should not adopt a standard specification for low-heat cement until after such study and later recommendation.

Sulphate-Resisting Cement

The sulphate-resisting portland cement standard under discussion is particularly characterized by the use of a 2-in. plastic mortar cube specimen and suggested strengths of 1,000 and 1,800 lb. per sq. in. at 7 and 28 days, respectively, a limit of 8 per cent of tricalcium aluminate, and a specific surface of not less than 1,500 sq. cm. per gram. No requirement other than the limit upon the amount of tricalcium aluminate was proposed as a measure of the ability of the cement to resist the action of sulphate salt-containing waters. This detail has caused considerable discussion. There are some who feel the indicated amount of tricalcium aluminate is too high, at least for high concentration of sulphates. Others think that if the resistance of a cement can be predicted by its chemical composition it can be done as readily by placing a limit upon the ratio of alumina to iron as by a limit upon the calculated tricalcium aluminate. Still others believe some type of specimen and test procedure should be developed which could be at least of the nature of a simulative or predictive service test, such as the expansion of a lean mortar bar subjected to the action of sodium sulphate (proposed by Thorvaldson) or the disintegration of set pastes of cement in solutions of sodium sulphate and the accompanying cumulative amounts of sulphuric acid needed to maintain the solutions at the same pH (proposed by Merriman).

Feret Reports New Tests of Concrete Mixtures

Results Disclose Complete Agreement with Water-Cement Ratio Law

NEW tests of concrete mixtures are reported by R. Feret in *Science et Industrie*, in Vol. 17, No. 5, 1933, pages 207 to 210.

Three series of concrete mixes, containing identical materials, were made up (1) with sufficient mixing water to yield a plastic mix, (2) identically proportioned but with a larger proportion of mixing water so as to yield a very wet mix, and (3) as in (2) but with the addition of sufficient sand to yield a consistency equal to that of (1).

Parallel mixes were made up with portland, portland blast-furnace, rapid-hardening portland, and high alumina cements. After determining unit weights, each mix was molded into specimens for bending and compression tests; some of these were tested after 48 hours' air storage, while the remainder were divided into three equal lots which were stored at room temperature in moist air, fresh water and sea water, respectively, and tested at 7 days and 28 days, 3 months, 1 year and 5 years.

The chemical characteristics of the cements used, the proportions of the mixes and the strength values obtained were tabulated and plotted. As was to be expected in accordance with Abrams' law, the fluid mix, although containing a higher proportion of cement by volume, yielded concretes with lower strengths than those yielded by mix No. 3. In general, the strength values for mix No. 3 were higher than those for No. 2, those for the portland rapid-hardening cement being markedly higher at early ages but lower after 6 months. No appreciable differences obtained, for any of the cements studied, between the strengths of mixes Nos. 2 and 3 as affected by the storage conditions. Taking the mean of the strength values for mixes Nos. 2 and 3 as a basis of comparing the strength developed in relationship to the water-cement ratio, it was found that, regardless of the type of cement used and the storage conditions, increase in the proportion of mixing water markedly reduced strength.—*Building Science Abstracts.*

Concrete Blocks Rich with Gold

FROM Kingsman, Arizona, comes the news that gold is being sold in concrete blocks, but that it is not part of a new gold fever. The concrete runs $12 to $15 a ton.

On running tailings of the Gold Road Mill, someone accidentally discovered that amalgam had penetrated the cement floor and now tons of it are being crushed and milled.

The Analysis of Fresh Concrete

Detailed Test Procedure by Method of Weighing in Air and Water—Illustrated by Example in Second Installment of Series

By **WILLIAM A. BLANCHETTE**
Highway Engineer, Division of Management, U. S. Bureau of Public Roads

In this article, the second of a series of three, the author describes, by means of an example, the test procedure involved in analyzing fresh concrete by the method of weighing in air and water.

Determination of correction factors because of grinding action on aggregates will be discussed in the final installment.—Editor.

IN connection with some recent work involving the analysis of samples of fresh concrete the second method was used, with what is considered to be satisfactory results. The washing machine described in *Public Roads*, November, 1932, was used as a means of separating the ingredients, and of determining some of the correction factors. As an illustration of how this method was applied, an actual example, taken from these analyses, will be given showing each operation and the manner in which it was conducted.

Five 30-lb. samples of concrete were removed from each batch of concrete for analysis to determine the uniformity with which the ingredients were distributed throughout the batch. The weights of the ingredients in the batch were:

Cement	2,325 lb.
Fine aggregate	7,480 lb., including absorbed and surface water, if any.
Coarse aggregate	9,355 lb., including absorbed and surface water, if any.
Water (added)	1,418 lb. = 170 gallons.
Total batch weight	20,578 lb.

This batch was mixed in a No. 126-S revolving drum mixer.

Preliminary Determinations

Specific Gravity of Aggregates

Representative samples of coarse aggregate and fine aggregate were obtained from the aggregate supply being used. Three weights were determined for each sample as follows:

1. Weight of completely saturated sample, immersed = $W_{w}l$
2. Weight of same sample, bone-dry, in air = Wa
3. Weight of same sample, bone-dry, immersed in water, this weight obtained immediately on immersion = W_w

The absolute specific gravity of the aggregate is Sp. Gr. (Abs.) $= \frac{Wa}{Wa - W_{w}l}$. This represents the net unit volume of aggregate as bounded by the external surfaces minus the volume of the internal spaces that are capable of being filled with absorbed water. It is the volume of solid matter in the aggregate.

The apparent specific gravity of the aggregate is Sp. Gr. (app.) $= \frac{Wa}{Wa - W_w}$. This represents the unit volume of aggregate as bounded by the external surfaces.

The specific gravity (absolute) was used for converting the immersed weights of the aggregate in the completely saturated state, to the corresponding air weight in the bone-dry state. The specific gravity (apparent) is used for converting air weights to solid volumes when these conversions are desired. Several determinations were made both for the absolute and apparent specific gravities. Each sample used for the determination was sufficiently large to be representative of the aggregate used in the concrete. The average of these several determinations were used in the analysis. Additional determinations were made during the progress of the analysis for the purpose of detecting significant changes which might occur in the structure of the aggregates. The specific gravity of the sand can be expected to increase as the size of the sand particles are decreased due to the grinding action to which the sand is subjected in the mixing operation. This condition may or may not warrant an adjustment in the specific gravity value used in the analysis.

Absorption of Water by Aggregates

The same weights that were obtained for the specific gravity determinations were used to determine the maximum percentage of water that the fine and coarse aggregates were capable of absorbing.

Maximum percentage of water absorbed by the aggregate $= \frac{W_{w}l - W_w}{Wa} \times 100$ or $\frac{\text{Sp. Gr. Abs.} - \text{Sp. Gr. App.}}{\text{Sp. Gr. Abs.} \times \text{Sp. Gr. App.}} \times 100$ in terms of the two specific gravities. There may be some objection to this method of determining absorption, since it involves the immersed weight of a bone-dry sample of aggregate. With some types of aggregates considerable absorption may take place before the immersed weight can be obtained. For the types of aggregates generally used in concrete the amount of absorption taking place during the immersion and weighing operation, which usually takes less than one minute, would probably have no adverse effects on the results. The alternate method of determining absorption by surface drying the aggregate is subject to inaccuracies because of the difficulty of determining the surface-dry condition. This is particularly true of the fine aggregate. The application of the absorption correction in an analysis of this kind is not of major importance. The method given should be sufficiently accurate, unless it is found in the immersed weighing that the rate of absorption is too rapid to give satisfactory results, in which case the surface drying method can be resorted to. These absorption determinations were made in connection with the specific gravity determinations. The average of several determinations was used in the analysis.

Specific Gravity of Cement

A representative sample was obtained from the cement supply being used. The specific gravity used for converting the immersed weight of the cement in the sample of concrete being analyzed to its corresponding air weight is $\frac{Wa}{Wa - W_w}$, in which—

Wa = the weight of a sample of cement (in its natural state) in air.

W_w = the immersed weight of this same sample of cement.

This weight was obtained after a period of immersion in water approximating the period of time that the cement and water were in contact in the batch of concrete, from the time these materials entered the mixer drum until the sample of concrete being analyzed was weighed immersed. In the analyses from which this example is taken this period of time was 45 minutes. The immersed weight of a sample of cement can be expected to increase with the period of immersion in water. It is therefore necessary to obtain the immersed weight used in the specific gravity determination after the proper period of immersion. The average of several specific gravity determinations was used in the analysis. These determinations were repeated from time to time during the analyses as a check. The specific gravity value used for converting air weight of cement to corresponding solid volume, when these conversions are desired, is determined by the A.S.T.M. method.

Correction Factor for Cement Retained on No. 100 Sieve

The same sample of cement used for the specific gravity determination was also used for determining the percentage of cement retained on the No. 100 sieve. After the immersed weight was obtained the sample was placed in the washing machine and washed until all cement that would pass the No. 100 sieve had been washed out. The cement remaining in the washing machine (if any) was placed in the container and weighed immersed. The percentage of cement retained equals

$$100 - \frac{W_w - W_{w2}}{W_w} \times 100$$

in which W_{w2} equals immersed weight of cement remaining in washing machine. The average of several of these determinations was used in the analysis.

Results of Preliminary Determinations

Specific gravity of coarse aggregate (absolute)	2.66	
Specific gravity of fine aggregate (absolute)	2.68	
Specific gravity of cement	3.17	
Maximum absorption of water by coarse aggregate	0.3	per cent
Maximum absorption of water by fine aggregate	0.5	per cent
Percentage of cement retained on No. 100 sieve	0.0	per cent

DETERMINATIONS CONNECTED WITH EACH BATCH SAMPLED

As the total batch was being proportioned the weight of each ingredient was recorded. A sample of both coarse and fine aggregate weighing 15 to 20 lb. each was obtained by intercepting the flow of these materials as they were being charged into the weighing hopper from the storage bin. These samples were obtained for every batch sampled.

Total Water in Aggregates

An aggregate entering the mixer may be in a state of complete absorption, with or without free water on the external surfaces; its internal pores may be only partially filled with water, or the aggregate may be in the bone-dry state. The actual condition of the aggregate as regards both free and absorbed water must be determined in order to correct the total batch weights so that these weights will represent the aggregates in the bone-dry state, a basis which is considered to be more satisfactory than the surface-dry basis. The sample of fine aggregate and the sample of coarse aggregate were weighed in air as soon as they were obtained as described above. Each sample was then weighed immersed. This weight is $W_w l$. The period of immersion before the immersed weight was obtained was of sufficient extent to allow complete absorption to take place should the aggregate not be in this state when it was batched. The immersed weight was converted to the corresponding bone-dry air weight. The total percentage of water contained in the aggregate is $\frac{W - W_c}{W_c} \times 100$ in which—

W = actual weight of sample in air (in existing state of water content).

W_c = bone-dry air weight of same sample computed from the immersed weight $W_w l$.

$$W_c = \frac{\text{Sp. Gr. (Abs.)} \times W_w l}{\text{Sp. Gr. (Abs.)} - 1}$$

Should the total percentage of water in the aggregate be greater than the maximum percentage of absorption, as calculated in the preliminary determinations, the aggregate contains both absorbed and free water. The percentage of free water equals the total percentage of water minus the maximum percentage of absorption. Should the total percentage of water equal the maximum percentage of absorption, the aggregate contains no free water. Should the total percentage of water be less than the maximum percentage of absorption the aggregate contains no free water and only a portion of the water that it is capable of absorbing. Should the total percentage of water equal zero, the aggregate is in the bone-dry state.

TABLE No. 2—RESULTS OF FREE AND ABSORBED WATER DETERMINATIONS

Aggregate	Weight of sample In air Pounds W	Immersed Pounds W_{wl}	Immersed weight converted to bone-dry air weight Pounds W_c	Total percentage of water in aggregate
Fine	19.66	11.74	18.73	5.0
Coarse	22.74	14.00	22.43	1.4

Free water in fine aggregate = 5.0% — 0.5% = 4.5%.
Free water in coarse aggregate = 1.4% — 0.3% = 1.1%.

TABLE No. 3—CORRECTING TOTAL BATCH WEIGHTS

Material	Wt. as proportioned Lb.	—Weight of water— Absorbed Lb.	Free Lb.	Total Lb.	Bone-dry wts. Lb.	Corresponding weights of 30-lb. batch
Cement	2,325				2,325	3.39
Fine aggregate	7,480	36	321	357	7,123	10.39
Coarse aggregate	9.355	28	102	130	9,225	13.45
Totals		64	423	487		
Absorbed water		64			64	0.09
Free water	1,418		423		1,841	2.68
Totals	20,578				20,578	30.00

Correction Factors for Aggregates Retained on and Passing Nos. 4 and 100 Sieves

The same sample used for the total water determination was used for these determinations. After the immersed weight of the aggregate was obtained the sample was placed in the washing machine and washed until no more material passed the No. 100 sieve. The No. 4 sieve in the machine was then held in the horizontal plane and the drum shaken until complete separation had taken place on this sieve. The aggregate retained on the No. 4 sieve and the aggregate passing the No. 4 sieve and retained on the No. 100 sieve was weighed immersed. By using these immersed weights and the immersed weight of the total sample the correction factors for each aggregate were determined. The correction factors for the fine aggregate are:

1. Initial percentage of fine aggregate passing the No. 100 sieve.
2. Initial percentage of fine aggregate retained on the No. 4 sieve.

The correction factors for the coarse aggregate are:

3. Initial percentage of coarse aggregate passing the No. 100 sieve.
4. Initial percentage of coarse aggregate passing the No. 4 sieve and retained on the No. 100 sieve.

TABLE No. 4—RESULTS OF CORRECTION FACTOR DETERMINATIONS

Sample	Weight of sample immersed	Immersed weights and percentages retained on and passing sieves: Retained on No. 4 Wt.	Pct.	Passing No. 4, retained on No. 100 Wt.	Pct.	Passing No. 100 Wt.	Pct.
Fine aggregate	11.74	00.95	8.1	10.58	90.1	0.21	1.8
Coarse aggregate	14.00	13.62	97.3	0.31	2.2	0.07	0.5

(*To be concluded*)

Stronger Bond of Deformed Bars Not Fully Recognized

Investigator Finds Bond Resistance Nearly Double That of Plain Bars—Would Reduce Allowable Bond Stress in Plain Reinforcement

EVIDENCE pointing toward needed changes in standards for the design of reinforced concrete structural members, in so far as the standards relate to bond between concrete and plain or deformed bars, is disclosed by C. Mackintosh as the result of a series of tests conducted in the department of civil engineering of Colorado College. He presents the test data in his Master's thesis.

Essentially, he finds that the difference in bonding strength of plain and of deformed bars is much greater (in favor of deformed bars, of course) than is reflected in commonly accepted allowable working stresses. His summary and conclusions follow:

(1) The horizontally-cast specimens yielded 81 per cent of the bond resistance of the vertically-cast specimens. This was probably due to both laitance and to small water globules which gather under all horizontally cast rods.

(2) The deformed bars yielded over 85 per cent more bond resistance than did the plain bars. Since the present standards allow only 25 per cent more bond load for approved deformed bars, they are obviously inconsistent when applied to the mix and reinforcing used in these tests.

(3) The bond of the plain bars gained at about the same rate as the crushing strength of the compression cylinders from one week to one month; the bond of the deformed bars gained about 10 per cent more rapidly (computed at .0005 inch slip). It is recommended that the effects of long time drying of thin sections of reinforced concrete be investigated.

(4) Since the first end slip does mark the beginning of the end, it is recommended that the criterion of safe bond be reduced below .001 inch slip. The tests reported in this paper point to safety at about .0005 inch slip. The present standards when applied to these tests gave the following factors of safety,—when considering .0005 inch slip as the safe limit in the first column and when considering .001 inch slip as the safe limit in the second column:

Horizontal plain bars	1.7	2.3
Vertical plain bars	2.2	2.8
Horizontal deformed bars	2.5	3.2
Vertical deformed bars	3.0	3.9

In view of the low factor of safety which may be obtained by construction which satisfies the present bond stress design requirements, it is recommended that the allowable bond stress for plain bars be reduced.

(5) The plain square bars had about ten per cent stronger bond than the plain round bars at one month and also at three months. Neither the square nor the round deformed bars showed any valuable advantage over each other at one month, however, the round deformed shape showed four to fifteen per cent advantage at three months.

(6) The tension in the concrete around the deformed bars, caused by bond stress, was very evenly distributed.

All the concrete used in the tests was mixed by weight, in the proportions of 1-2.71-2.19, with a water-cement ratio of 0.8.

Colorimetric Test for Impure Sands Not Conclusive

Committee C-9 of A. S. T. M. Points Out Need for Discretion in Interpretation of Results—Color Effects Far from Uniform

IN an appendix to its report to the annual meeting of the American Society for Testing Materials, Committee C-9 on Concrete and Concrete Aggregates emphasizing the fact that extremely wide variations in test results are being obtained when applying the society's Standard Method of Test for Organic Impurities in Sands for Concrete (C40-33). The subject is presented in the form of an abstract of an unpublished paper by C. L. Ford, assistant chemist in the research laboratory of the Portland Cement Association.

Test Has Its Limitations

It is explained that questions arising from time to time regarding the applicability and limitations of the Abrams-Harder colorimetric test[1] and the A. S. T. M. Standard Method of Test for Organic Impurities in Sands for Concrete (C40-33),[2] led to a quantitative study of results obtained with tannic acids from six different sources. Study was also made of the colors developed by a natural sand containing organic matter and treated with 3 per cent sodium hydroxide solution, the sand being mixed in different proportions with a sand free from organic matter.

The methods used were those indicated in the above references, with some modifications that would give checks on the quantitative interpretation of the colors developed. Observations of the intensity of the colors were made at 3, 6, 24 and 48 hr. after preparation of the solutions.

Differences in Color

In the study of the various tannic acids it was found that very considerable differences in color were obtained. The differences were most marked at the 6-hr. period, all showing decided fading at the 24-hr. period. This may be explained in part by the greater clarity of the solutions at the 24-hr. period. At 48-hr. all solutions had faded to a small fraction of their early value. It was also noted, particularly in the early periods, that the color values obtained with different amounts of the standard tannic acid solutions were not in agreement.

In the study of the colors produced by the natural sand combinations, it was found that the color values were quite erratic. In most cases the color with a given amount of filtered solution was not proportional to that obtained by using a different amount of the same solution. It was also found that the color value with different proportions of the contaminated sand was not proportional to the amount of this sand.

It should be noted that the foregoing results do not necessarily disqualify the test. They simply bring out the fact that the intensity of the color is not a quantitative indication of the amount of organic material present; but since the color value means nothing until it is correlated with strength tests of the sand in question, this lack of proportionality is not important.

Conclusions

The color values obtained from tannic acid, as used in the colorimetric test of sand, appear to vary considerably, depending on the brand and grade of tannic acid, the relative amounts of the constituents, and the time of standing before comparison is made. Similarly, the color value for a given sand based on the sodium tannate standard is subject to the same variable factors.

The first of the above factors applies whether the test is preformed in accordance with the A. S. T. M. standard or according to the Abrams-Harder quantitative method. The second applies only to the latter method, while the third is eliminated if definite time is adhered to. This is fixed at 24 hr. in the A. S. T. M. method.

It is the intent of the A. S. T. M. method C40 not to prescribe a hard and fast rule for accepting or rejecting concrete sands, but rather to serve as a warning that sands which produce dark colors should be subjected to other tests to determine their suitability for use in concrete. The results of this investigation serve to further emphasize the discretion which must be used in interpreting the results of the colorimetric test.

Asphalt Expansion Joints Improved with Cotton Seed Hulls

COTTON seed hulls have been employed in asphalt expansion joints in concrete roads in India, according to the *Indian Concrete Journal*, issue of August, 1933, page 260.

The use of the hulls minimizes the extrusion of the asphalt from the joints during hot weather. Joints are constructed by first filling the joint partly with asphalt, after which cotton seed hulls were poured into the joint with the aid of a V-shaped trough. The quantity of hulls was such that, after being tamped, the layer was about 3 in. thick. Then asphalt was poured in a second time, and another 3-in. layer of hulls was placed and tamped. This was followed by the final application of asphalt, the joint having been filled flush with the surface of the concrete slab.

In view of the fact that cotton seed hulls are available in large sections of this country, it is suggested that highway departments in states of the cotton belt may find it well worth while to make some experiments in this direction.

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[1] See "Suggested Colorimetric Tests for Organic Impurities in Sand," Appendix II, Report of Committee C-9 on Concrete and Concrete Aggregates, *Proceedings*, Am. Soc. Testing Mats., Vol. XVII, Part I, p. 327 (1917).

[2] 1933 Book of A. S. T. M. Standards, Part II, p. 236.

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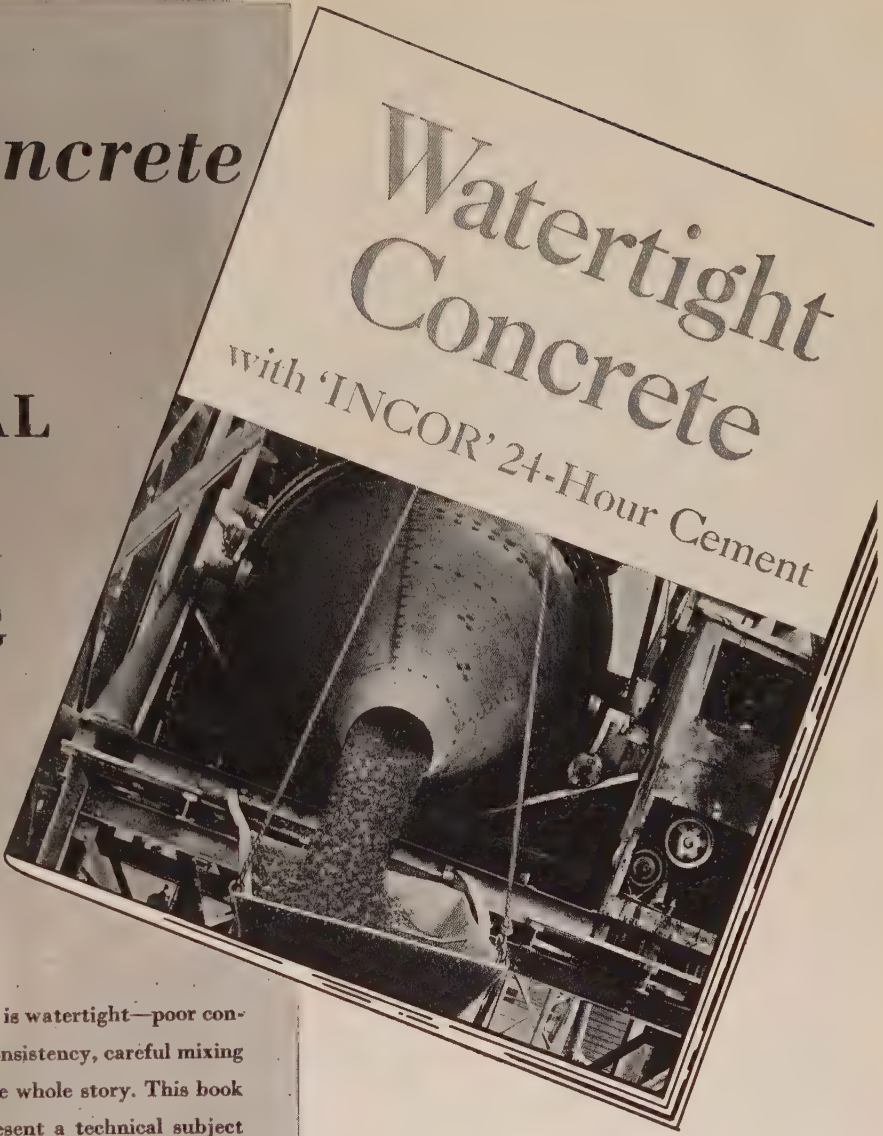

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A. S. T. M. Specification for Curing Concrete with Sodium Silicate

Committee C-9 Requests Criticisms and Suggestions—The Proposed Specifications in Full

WITH the view of drawing out constructive criticisms and suggestions pertaining to the proposed Tentative Specifications for Sodium Silicate for Curing Concrete, Committee C-9 of the American Society for Testing Materials has included the proposed standard in its report presented to the annual meeting of the society. The specification, comprising six short paragraphs, is here given in full.

Scope

1. These specifications cover sodium silicate to be applied to the surface of concrete for the purpose of preventing moisture loss during curing.

Properties and Tests

2. The sodium silicate shall have a density of not less than 42.25 deg. Baume at 60 F. (15.5 C.).

3. The ratio of sodium oxide, Na_2O, to silica, SiO_2, shall be Na_2O to not less than 3.2 SiO_2.

Packing and Marking

4. The sodium silicate shall be delivered in 50 to 55-gal. nonreturnable steel drums. The name of the manufacturer, the actual net weight and the grade of sodium silicate shall be plainly marked on each container.

Inspection and Sampling

5. Sodium silicate may be sampled for purpose of tests either at the plant prior to delivery or on the site of the work, at the option of the purchaser. At least one sample from every ten drums shall be taken to determine compliance with these specifications.

Rejection

6. The sodium silicate shall be rejected if it fails to meet any of the requirements of these specifications.

Criticisms and suggestions should be addressed to R. R. Litehiser, Secretary of Committee C-9, Ohio State Highway Testing Laboratory, Ohio State University, Columbus, Ohio.

Sewage Disposal Needed to Protect Nations Water Supply

(An Editorial)

ON page 11 of the June issue of "Concrete" an editorial pointed out the importance of sewage disposal as a health measure. The belief was expressed that through the PWA loans for projects of this type, a definite impetus has been given to the growing public sentiment favoring sewage disposal.

Now Mother Nature has provided an impetus that is even more powerful, for the severe drought conditions in the middle west have focussed attention on all available sources of water supply. Shortage of water has been made doubly serious by insanitary disposal of sewage into the extremely low water courses. Few people realize the importance of adequate disposal of domestic wastes. Sewerage facilities, like water supply service, are taken for granted. It is only in such emergencies as the present that local interest can be aroused.

In every state there are numerous communities where the purity of drinking water is dependent upon sewage treatment in other communities upstream. It is a just obligation upon each community to see that its wastes are so treated or disposed of that they do not contaminate their own water supply or that of other communities. An adequate sewerage system with a modern sewage disposal plant is urgently needed in hundreds of communities.

The need was recognized by the Federal government, which allotted $133,000,000 of the Public Works funds for sewage disposal projects that were deemed essential. Millions more could be spent to good advantage; but, unfortunately, worthwhile projects are destined to lie dormant through lack of public support. In spite of the lesson of the drought, the apathy of the public in many communities toward projects of such vital concern is amazing. Let some one with a communicable disease expose others and we immediately and emphatically demand isolation of the individual; but we are not equally insistent, in fact very little concerned, when thousands are exposed to water-borne diseases caused by insanitary disposal of wastes.

Possibly the smaller cities of the nation have had a poor example set before them—the spectacle of our second largest city cutting a channel through a natural divide and dumping its sewage into a river system of another drainage area. That disgraceful situation is slowly being corrected, and in time it will be eliminated.

In the meantime, let no one forget that hundreds of smaller cities and towns are equally culpable, on a smaller scale. Only through sewage disposal for all communities, large or small, can the purity of our threatened water supply be safeguarded.

The conservation of that water supply is another national problem—one that is receiving careful study and will be undertaken in due time; but the most important matter at present is to stop contamination of our existing supply.

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A department devoted to the solution of problems encountered in concrete work. Readers are welcome to add to or improve upon the suggestions printed and to submit their views for possible publication.

Beer Not Likely to Damage Terrazzo Floor

We have an opportunity to install a terrazzo floor in a large bottling house for a brewery, but the company's engineer seems to hesitate because of his fear that the beer might in time damage the floor. Can you give us some information on this subject?—F. L. R., Greensburg, Penna.

You should have no trouble whatever with a terrazzo floor in that location. Beer is only slightly acid and it has little or no effect on a well-made floor of ordinary concrete. In the case of terrazzo, its density is so great that a liquid of this nature will not be absorbed by the floor, and for that reason the cement binder can not be attacked.

As a matter of further assurance to the construction engineer on this work, it would be well to offer to apply a coat of linseed oil or some commercial floor hardener to the floor after the terrazzo has hardened. This would aid further in repelling liquids.

As a matter of further information on coatings to resist acids, you are referred to a short article on page 15 of the July, 1933, issue of CONCRETE, entitled "Acid Resistant Linings for Concrete Tanks."

Molding and Vibrating Precast Piles

In the article in your June issue, headed "Concrete and Creosoted Wood Piles Compared," the statement is made that "When concrete piles are manufactured in gang molds with internal vibrators, the cost per foot may not differ greatly from that of creosoted wood piles."

Does the writer of the article have reference to the usual procedure of casting piles between forms on a timber platform, or is he referring to some new or patented system designed as an improvement over the usual procedure?—B. Y. D., Washington, D. C.

The reference to gang molds and vibrators does not pertain to any new or novel or patented method. The particular work the writer had in mind was, in fact, the casting of piles for the Baltimore Pier. That work is still under construction, although the reinforced concrete piles have all been cast and placed. On that work, the piles were cast in long series of gang molds placed side by side with an internal high-frequency vibrator put into action at each end of the mold as the concrete was placed. The use of these vibrators eliminated a great amount of labor ordinarily involved in tamping, and much better workmanship was obtained than could possibly have been obtained by hand tamping.

Similar work was recently under way in Milwaukee, in the precasting of the diffuser plate containers for the Milwaukee sewage disposal plant. These were beam-like units about 12 ft. long. One high-frequency vibrator was placed near the mid-point of the mold, and as soon as the mold was filled with concrete the vibrator was turned on for about 15 seconds. In that case the vibrator was not the internal type, but was mounted on a short base board which rested on the edges of the metal molds. Either this type or the internal type should be found satisfactory in the casting of elongated units such as concrete piles.

Directories of Contractors

Can you refer me to a directory of contractors who specialize in concrete construction?—C. R. A., Portland, Maine.

Practically all contractors are experienced in placing concrete work, for all construction projects of importance include some concrete. One publication on this subject is entitled "Directory of Contractors," published by the Bureau of Contract Information, Inc., 729 Fifteenth Street, N. W., Washington, D. C. It contains the names of about 5,000 contractors and is priced at $2.00. A review of this book appears on page 20 of the June, 1933, issue of CONCRETE.

Another book, entitled "Fifteenth Census of the United States—Construction Industry, Summary for the United States," contains names and addresses of more than 30,000 individuals or firms of contractors. This book is reviewed on page 16 of the May 1933, issue of CONCRETE. A copy may be obtained for 20 cents from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Manufacture of Concrete Pipe

I am interested in the design and manufacture of large-diameter precast reinforced concrete pipe, and wish to familiarize myself with this subject. Can you refer me to books and other references covering this industry?—F. G. C., Los Angeles, Calif.

In the May (1930) issue of CONCRETE, pages 27 to 29, there is a detailed description of the factory procedure followed by a leading manufacturer of large-diameter concrete pipe. Doubtless you can obtain a bound reference volume of CONCRETE at your public library or at the Los Angeles office of the Portland Cement Association.

You should consult also an article by George W. Gleeson on "Grading Aggregate for Mechanically Compacted Concrete Pipe," printed in the June (1932) issue of CONCRETE, pages 7 to 11.

It is suggested further that you write to the American Concrete Pipe Association, 33 W. Grand Ave., Chicago, Ill., for copies of their booklets on *Concrete Pipe for Irrigation*, *Concrete Pipe Sewers*, and *Concrete Pipe Culverts*.

From the Patent Office

By J. KAPLAN
Patent Attorney, Washington, D. C.

Pipes or hollow ware of fibrous cement mortar: Guido Vianini, Rome, Italy. U. S. Pat. 1,954,902.—The method for compressing the wall of pipes made of suitable plastic material applied on the outside of a cylindrical rotatable mold consists in applying pressure about a limited portion of the material on the mold, rotating the mold and simultaneously applying pressure over succeeding portions, reversing the direction of rotation of the mold simultaneously reversing the direction of travel and the application of pressure to the material on the mold, and graduating the tension of the pressure-applying-means at each reversal of travel and application of pressure to effect compression of the tube and to graduate the value of compression so as to pass by degrees from a minimum to a maximum value and eliminate the effect of lamination of the wall of the pipe.

●

Apparatus for compacting concrete: Francis P. Sloan, Scarsdale, N. Y. U. S. Pat. 1,955,101.—The compacting apparatus comprises a base adapted to rest continuously upon the surface to be treated, an inertia weight of substantial mass movably mounted upon the base to be vibrated toward and from the base causing compacting impulses of the base—a floating load of substantial weight comparable with that of the base mounted or suspended in resilient relation to the base whereby to impose continuously its weight as a supplemental gravity load upon the base without substantial resistance to the vibration of the base—and a power operable means or motor for vibrating at high speed, not in resonance with the load.

●

Wall construction: This construction comprises two opposed tiers of blocks. In each tier the blocks of a lower course have transverse corrugations on their upper faces and the blocks of the next higher course have transverse corrugations on their lower faces, flanges which extend in a vertical plane being formed around the outer faces of the blocks in each tier of the wall, and a cementitious filling in spaces, tie rods occupying spaces formed by opposite corrugations, the tie rods having lateral extension to key them in place, each of the rods being thereby keyed to blocks of both tiers, the length of the tie rods being slightly less than the distance between the flanges at opposite sides of the wall.

●

Applying bitumen to concrete foundation: Leonard Gowen Gabriel and John Frederick Blott, London, England. U. S. Pat. 1,953,294.—This method consists of laying a concrete foundation (a road or the like) and, while this is still in a semi-plastic condition, applying to it a layer of bitumen-impregnated concrete prepared by incorporating an aqueous bituminous emulsion free from soap with a plastic concrete mixture in proportions of about 10 per cent reckoned by weight on the concrete, and finally, after the bitumen impregnated layer has set, coating the layer with pure bitumen by treatment of the surface with an aqueous emulsion of bitumen.

●

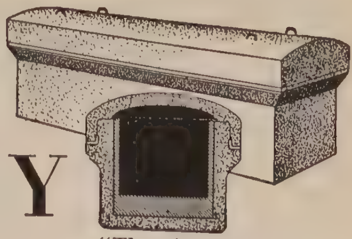
Refractory cement: George F. Comstock, Niagara Falls, New York. U. S. Pat. 1,952,119.—The refractory slag-resistant cement produced by this process contains substantially 50 parts, by weight, of finely ground magnesite; 15 parts of electrically fused, finely ground magnesia; and 10 parts of refined zircon milled to 300-mesh. The mixture is bonded with a sodium silicate solution of about 1.3 sp. gr., wherein magnesite shrinkage is counteracted by the expansion of the magnesia-zircon compounds formed when the cement is burned at temperatures up to 2,900 deg. F.

●

Making colored cement: John Finn, Jr., Berkeley, Calif. U. S. Pat. 1,958,615.—This process of making colored cement consists of heating portland cement or clinker with from one-tenth to five per cent of sulphur to a temperature from 800 deg. F. to 1,800 deg. F. for a period of time and with substantial exclusion of air to materially change the color of cement or clinker, and then adding an additional quantity of sulphur to further modify the color produced.

●

Reinforced concrete fence: N. C. Nelson, Worcester, Mass. U. S. Pat. 1,954,256.—This fence is made of interconnected sections, each section consisting of one post, two rails, and vertical pickets—the pickets being integral with the rails and the rails integral with the posts so that the entire section is integral and undetachable.



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New Books and Pamphlets

Getting Ahead

If You Want to Get Ahead, by Ray W. Sherman. Published by Little, Brown & Company, Boston. Cloth, 186 pages, 5 by 7½ in. Price $1.50.

There is nothing in this book about either cement or concrete; but there is much in it—very much, in fact—that should be of intense interest to readers of Concrete, particularly those who are looking to get ahead.

The book is recommended also as one which, with profit to all, might be distributed to potential executives throughout an organization by its directing head. The author, himself a successful man, bases his conclusions on facts instead of theories.

Skidding Tests

Skidding Characteristics of Road Surfaces, by R. A. Moyer, including determination of Coefficient of Friction Between Tires and Road Surfaces, by Karl W. Stinson and Charles P. Roberts; a 69-page preprint from the *Proceedings* of the thirteenth annual meeting of the Highway Research Board, Washington, D. C.

Tests conducted over a period of two years, at Iowa State College, are reported in this preprint. The tests in question were run upon 25 different types of surfaces, including portland cement concrete, brick, gravel, mud on concrete, asphalt, tar, road oil, cinders, asphalt plank, steel plates, and wood plank.

Design of Continuous Beams

Der Durchlaufende Trager (Continuous Beams), by Dr. A. Kleinlogel. Second edition, published by Wilhelm Ernst & Sohn, Berlin, Germany. Cloth or paper binding, 192 pages, 6¾ by 9¾ in. Numerous line diagrams. Price: Cloth binding, 18.50 gold marks; paper cover, 11.0 gold marks.

This book is primarily a designers' handbook, containing moment and shear diagrams and coefficients corresponding to a great range of conditions of loading, all of which may be readily understood by designers having a fair knowledge of the German technical language.

Location of Cement Plants

Map of Portland Cement Plants of the United States, by Ellis C. Soper. Published in 1933 by J. H. H. Muirhead, 230 West 108th Street, New York. Printed on paper in black-and-white, 17 by 22 in. Price $1.00.

All cement manufacturing plants in the United States are spotted on the map, as well as the names of towns where the plants are located. Names of companies are also given. Colored wall maps of the same and larger sizes, with cloth back, are supplied at higher prices.

Concrete Pipe Sewers

Concrete Pipe Sewers is the title of a new 28-page bulletin issued by the American Concrete Pipe Association, 33 W. Grand Ave., Chicago. Copies will be mailed on request.

Because of the growing public interest in sewerage systems and sewage disposal plants, this well-illustrated bulletin should be in the hands of every engineer concerned with such problems. Several full-page design diagrams permit the determination of required pipe sizes for various given conditions.

ORGANIZATIONS

American Association of State Highway Officials; W. C. Markham, Executive Secretary, 1222-24 National Press Building, Washington, D. C.

American Chemical Society, Mills Building, Washington, D. C.

Amercian Concrete Institute; Harvey Whipple, Secretary, 7400 Second Blvd., Detroit, Mich. Thirtieth annual convention, February 20-22, Royal York Hotel, Toronto, Canada.

American Concrete Pipe Association; M. W. Loving, Secretary, 33 West Grand Ave., Chicago.

American Institute of Chemical Engineers, Bellevue Court Bldg., Philadelphia, Pa.

American Railway Engineering Association; E. H. Fritch, Secretary, 59 East Van Buren St., Chicago, Ill.

American Road Builders' Association; Chas. Upham, Engineer-Director, National Press Building, Washington, D. C.

American Society of Civil Engineers; Geo. T. Seabury, Secretary, 33 West Thirty-Ninth St., New York City.

American Society for Testing Materials; C. L. Warwick, Secretary-Treasurer, 260 S. Broad St., Philadelphia, Pa.

Associated General Contractors of America; E. J. Harding, Managing Director, 222 Munsey Bldg., Washington, D. C.

Building Officials Conference of America; Wm. F. Hurd, Secretary, Room 203, City Hall, Indianapolis, Ind.

Cast Stone Institute; L. A. Falco, Secretary, Chapel St. and Blatchley Ave., New Haven, Conn.

Cement Institute; H. C. Lundborg, General Manager, 11 East 44th St., New York City.

Concrete Reinforcing Steel Institute; R. W. Johnson, Secretary, 333 North Michigan Ave., Chicago, Ill.

Engineering Institute of Canada; 2050 Mansfield St., Montreal, Quebec.

Highway Research Board; Roy W. Crum, Director, 2101 Constitution Ave., Washington, D. C.

Joint Committee on Standard Specifications for Concrete and Reinforced Concrete; F. R. McMillan, Secretary, 33 West Grand Ave., Chicago.

National Board of Fire Underwriters; W. E. Mallalieu, General Manager, 85 John St., New York City.

National Concrete Burial Vault Association; J. H. Stuart, Secretary-Treasurer, Bremen, Ohio.

National Concrete Masonry Association; Horace W. Bush, Secretary and Treasurer, 211 Edgemont Place, Teaneck, N. J.

National Crushed Stone Association; J. R. Boyd, Secretary, 1735 14th Street, N. W., Washington, D. C.

National Fire Protection Association; Franklin H. Wentworth, Managing Director, 60 Batterymarch St., Boston, Mass.

National Lime Association; Norman G. Hough, Secretary and Manager, 927 Fifteenth St., N. W., Washington, D. C.

National Ready-Mixed Concrete Association; V. P. Ahearn, Secretary, 545 Munsey Bldg., Washington, D. C.

National Sand and Gravel Association; V. P. Ahearn, Executive Secretary, 545 Munsey Bldg., Washington, D. C.

National Slag Association; H. J. Love, Secretary-Treasurer, Earle Building, Washington, D. C.

National Terrazzo and Mosaic Association; J. M. Fuhrman, Secretary-Treasurer, 524 Brook Street, Louisville, Ky.

New Jersey State Concrete Products Association; Horace W. Bush, President, Lyndhurst, N. J.

Portland Cement Association; Edward J. Mehren, President; William M. Kinney, General Manager, 33 West Grand Ave., Chicago.

Rail Steel Bar Association; H. P. Bigler, Engineering Secretary; Builders' Bldg., 228 N. La Salle St., Chicago, Ill.

Wire Reinforcement Institute; R. D. Bradbury, Director, National Press Bldg., Washington, D. C.

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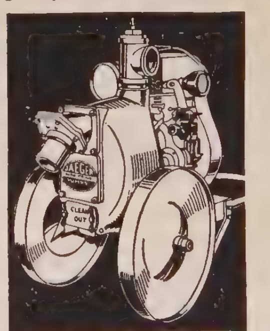

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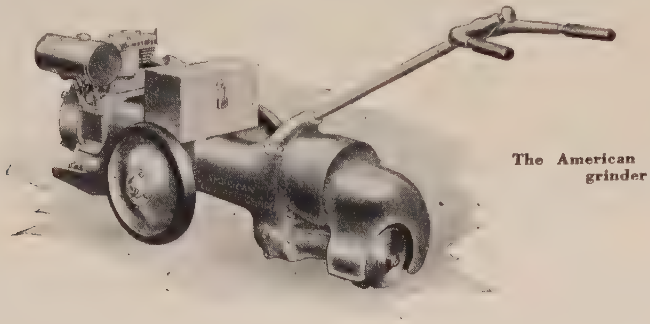


The American concrete grinder

●

SELFVULC is the registered trade name of a rubber compound which the Self-Vulcanizing Rubber Co., Inc., of Chicago, says is applied cold and which vulcanizes itself on exposure to air. It is available in either paste or liquid form. It is said to be successfully used in cement plants and in the building and construction fields. The maker recommends the use of plastic Selfvulc as a protective coat for handling machinery—belts, hoppers, chutes and spreading tables—and as an effective repairing material for belting.

●

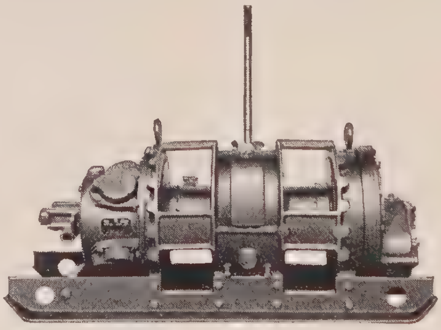
SPONGE rubber expansion joints have been conceived by The B. F. Goodrich Rubber Company. Since all masonry and structural materials expand when heated and contract when cooled, the ideal joint material is one which keeps the opening filled and tight at all times.

The Goodrich joint is said to be a specially compounded sponge rubber, highly elastic and resistant to aging. When installed, it is placed under compression so that during contraction of the structural material at the joint due to low temperature, the sponge expands, approaching its original or normal state, and then when the reverse condition takes place, due to high temperature, the sponge compresses or contracts as the members expand. The joint strip does not protrude because the cellular construction of the sponge rubber permits the compression to take place within itself. The action is said to be similar to that of a bellows.

In installation, strips and special-shaped pieces are cut to conform to the joint and cemented into place. In pouring the adjoining concrete, the hydrostatic weight of the concrete and the pouring action put the sponge under compression sufficient to compensate for the expanding action necessary to maintain a tight joint under extreme contraction movements. This is said to assure a satisfactory joint that remains tight and full under all conditions.

●

UTILITY air hoists is the subject of a new bulletin describing both the single-drum air hoist, used for such work as hoisting materials, moving timbers, spotting cars, etc., and the double-drum air hoist, used for slushing out material in mining work, loading cars, drag line excavating, etc.



Double-drum Utility air hoist with Joy Stick control

One of the interesting features of the double-drum utility air operated hoist according to the Ingersoll-Rand Company, New York City, is the so-called "Joy Stick Control," a single lever by means of which the operator has complete control of the hoist. The single control lever handles throttle valve and clutches at the same time.

SMITH metal laced joint, a product of the A. O. Smith Corporation, is now being distributed nationally by the American Steel & Wire Company, Chicago. A section of this new joint consists of two parts, handled as a single unit, and is placed in a longitudinal position between the slabs, the makers say. The result, in engineering language, will be a lacing together of the slabs, plus an interlock or transfer of load vertically, they claim. In other words, the tying feature conforms to the well known rule that "small members closely spaced are more effective than larger members widely spaced."

Industrial Literature

SHORT Cuts to Power Transmission has just been thoroughly revised, with new chapters added, and published by the Flexible Steel Lacing Company, Chicago. The company says it contains all information needed in solving any ordinary belt transmission problem as well as valuable material on good practice, and a mass of associated tables and data, written in a clear, simple manner that will make it valuable to the layman as well as the engineer.

●

MEDUSA Portland Cement Stucco is a new booklet by the Medusa Portland Cement Company of Cleveland covering the advantages of portland cement stucco, color, waterproofed stucco, specifications, stucco textures, tables of material required, and remodeling ideas.

Manufacturers' News

JOSEPH T. RYERSON & SON, INC., Chicago, has recently completed an extensive addition to the St. Louis plant. Approximately 40,000 sq. ft. of floor space has been added. Offices are equipped with an air conditioning and cooling system.

●

LINK-BELT COMPANY, Chicago, has recently opened a warehouse in Dallas, Texas, with a floor space of 10,000 sq. ft. The company's sales office will be located at the warehouse. E. G. Wendell is resident manager.

Vol. XLII
No. 7

Cement Mill Section of
Concrete

JULY
1934

Heat Recuperators at Kosmos Plant Return Big Saving in Fuel

Reduce Coal Requirements by 20 lb. per Barrel of Clinker—Burning More Complete, Grindability Improved, and Strength Increased

TWO of the rotary kilns at the Kosmosdale (Kentucky) plant of the Kosmos Portland Cement Co., each 8½ ft. in diameter and 125 ft. long, recently were equipped with the Vanderwerp heat recuperator and clinker cooler, the installations having resulted in a substantial saving in fuel and a distinct improvement in the quality and the grindability of the clinker. The Kosmosdale plant is operated under the dry process.

Heat Recuperator Primarily a Fuel-Saver

The Vanderwerp heat recuperator has been well known to the cement industry for several years. It is designed primarily as a fuel saver, rather than a clinker cooler as the latter term is commonly understood. That is, this recuperator does not cool the clinker down to the temperature required for grinding, though it does cool it to a dead black color, with a discharge temperature of around 750 to 800 deg. F. Considering that the initial temperature of the clinker is somewhere in the vicinity of 2,000 to 2,200 deg. F., the effectiveness of the recuperator may be realized. The important thing with respect to fuel saving is that practically all of this heat given off by the clinker is retained in the kiln and utilized with the secondary air of combustion.

From Rotary Coolers to Kilns

Originally this recuperator was developed for installation within rotary coolers, and several units of this type were installed, all of which have developed creditable records of performance. The Manitowoc (Wisconsin) plant of the Medusa Portland Cement Co. is one of the plants equipped with this type.

Later experiments and studies proved that the recuperator would be even more effective if installed within the kiln itself, at the discharge end. All of the more recent installations are of this type, the two at Kosmosdale being among them.

Pre-heating the Secondary Air

The design of the Vanderwerp recuperator takes full advantage of the combustion requirements in the burning of cement. As is well known, the air in a rotary kiln may be divided into primary air and secondary air. The primary air is that which is blown in through the blast pipe with the fuel. That is, it conveys the finely divided fuel into the kiln. The remaining air, known as secondary air, supports the combustion.

Because of the mechanical arrangement of the recuperator, the secondary air to support combustion is blown in through the recuperator and enters the kiln through the clinker bed. The kiln operator regulates the draft by means of the fan to the extent that this secondary air builds up a slight positive pressure in the discharge end of the kiln, a condition that is quite effective in preventing the entrance of cold air around the kiln hood.

How Leakage of Air Is Prevented

The manner in which this secondary air is brought into the kiln—under fan pressure—results in a reduction of draft in the stack end of the kiln. Another interesting result—arising from the fact that the secondary air enters the kiln through the clinker bed—is that practically all the clinker dust is carried back into the kiln, to become re-incorporated in the newly forming clinker. In consequence, the clinker discharged from the kiln is practically free of dust.

Metal Liner Plates in Discharge End

The standard recuperator unit contains four rows of metal liner plates carried on alloy-steel subframes. In the original recuperator design, as at first installed in rotary coolers, and later in kilns, the plates covered the entire inside of the shell of the cooler or kiln for a longitudinal distance of 8 ft. In the more recent design the plates are similarly placed within the discharge end of the kiln, but are spotted on centers that leave a clear space between plates. This space is occupied by a 4½-in. or 6-in. thickness of firebrick, the thickness depending on the diameter of the kiln.

Of the four rows or rings of plates, the first three rings are made of a high-grade heat-resisting chrome-nickel alloy steel, possessing also to a high degree the ability to resist abrasion. The plates in the fourth ring are made of a white iron alloy. The nose at the discharge end is composed of a ring of segmental units made of the same material as the fourth ring of plates.

It is through the hollow spaces in these plates, of course, that the incoming air passes and enters the kiln. The recuperator as a whole consists of an annular windbox surrounding the kiln near the discharge end, through which an air-blast is forced by means of a fan, the air passing through manifolds to the metal liner plates just mentioned. Through tuyere openings in these liner plates, as previously explained, the air enters the kiln, under some pressure, the main air-blast entering immediately under—and passing through—the bed of hot clinker.

Save 20 lb. of Coal per Barrel of Clinker

As to the actual saving in fuel, this naturally varies with different installations. It is known that in the two 8 by 125-ft. kilns at the Kosmosdale plant the actual saving, as compared with the previous fuel requirements of these same two kilns, amounts to 20 lb. of coal per barrel of clinker. The coal being used tests from 13,000 to 14,000 B.t.u. per lb. In a word, a saving of some 250,000 to 275,000 B.t.u. per bbl. of clinker has been realized. These figures are not final, but represent the best estimate of the plant management to date.

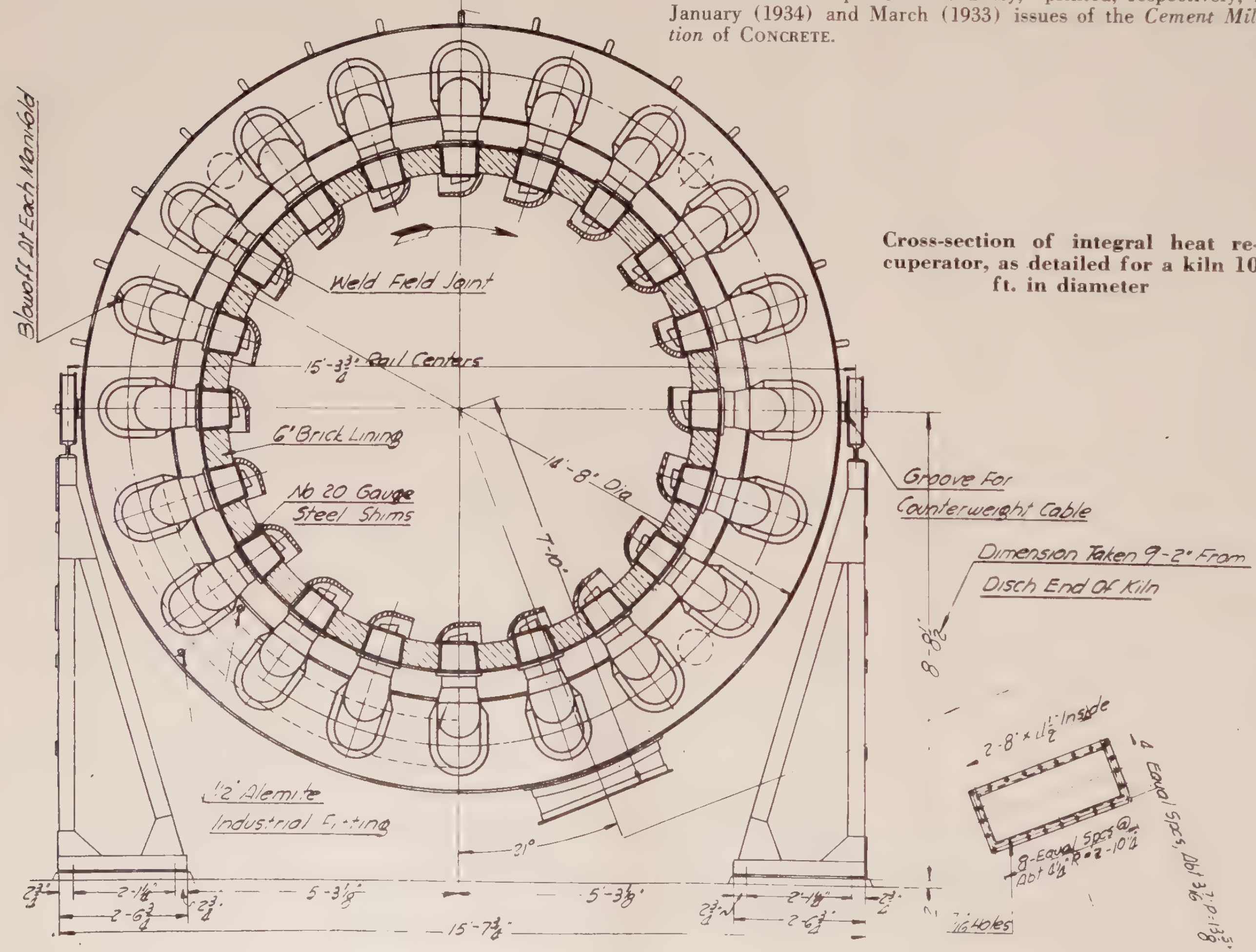
The clinker in these two kilns, moreover, is exceptionally well burned, being hard and vitreous. It is in these two recuperator-equipped kilns that the cement company burns its super, or high-early-strength, cement, because of the more complete burning obtained.

The principal advantages gained from the rapid cooling of the clinker lie in the improved grindability of such clinker and the greater strength of the cement. These advantages have been observed with respect to other types of equipment designed primarily as clinker coolers.* The reduction in grinding costs due to this improved grindability shows up mainly in the form of reduced power requirements per barrel of cement.

No Free Lime

Another important and significant fact noted at the Kosmosdale plant is the apparent absence of free lime in the high-early-strength cement produced in the two kilns involved. In all installations of this recuperator, tests have shown a lower free-lime content than that of the normal clinker. At the Kosmos Portland Cement Co.'s plant laboratory repeated tests of the high-early-strength cement have indicated "no free lime," a fact which provides eloquent proof of the completeness of the burning process, and suggests the possibility of carrying a higher lime ratio in the raw mix.

Acknowledgments: The Vanderwerp heat recuperator has been developed by H. Vanderwerp, vice-president of the Medusa Portland Cement Co., working in conjunction with the Manitowoc Engineering Works, of Manitowoc, Wisconsin. The Manitowoc Engineering Works, in cooperation with Mr. Vanderwerp and his associates, designed and installed the recuperator for the two kilns at the Kosmos Portland Cement Co. plant described, as well as all other units previously installed.



Cross-section of integral heat recuperator, as detailed for a kiln 10 ft. in diameter

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*See, in particular, articles headed "New Clinker Cooler Reduces Arkansas' Fuel and Grinding Costs," and "New Clinker Coolers Save Fuel and Improve Grindability," printed, respectively, in the January (1934) and March (1933) issues of the *Cement Mill Edition* of CONCRETE.

Accomplish Grinding and Drying in One Operation

Performance Record Shows Success of Operation—Raw Mill Hooked Up with Air Separator — Installation Occupies Little Space

(Translated from *Cemento* (Barcelona), Vol. IV, No. 39.)

THE installation here described comprises a short cylindrical raw mill which operates in conjunction with an air separator and a pneumatic conveyor, and which is utilized for grinding either dry or wet material. Following is the performance record obtained with a mill having a diameter of 7 ft. 10½ in.:

Hourly production of the raw mill	38,250 lb.
Percentage of raw meal retained on the 4,900-mesh[1] sieve	19.32%
Percentage of raw meal retained on the 900-mesh[2] sieve	0.75%
Power utilized by the motor of the raw mill	224 hp.
Power utilized by the motor of the pneumatic conveyor fan	109 hp.
Total power utilized	333 hp.
Production per hp.-hr.	115 lb.
Hourly consumption of coke (7,000 calories) for grinding and drying	293 lb.
Consumption of coke per 100 lb. of raw meal	0.77 lb.
Consumption of heat per lb. of water, with 5 per cent of moisture in material	431 cal.

Final moisture content of the raw meal: 0.15 to 0.5 per cent maximum.

A series of tests were conducted, the results of which are shown graphically in Figures 1 and 2. The curves in Figure 1 indicate the production in ton-hours for the two grades of fineness—the material retained on the 4,900-mesh sieve and that retained on the 900-mesh sieve. From Figure 2 may be deduced the power consumption in kw. per ton and kw. per hour for the different particle sizes retained on the 4,900-mesh sieve.

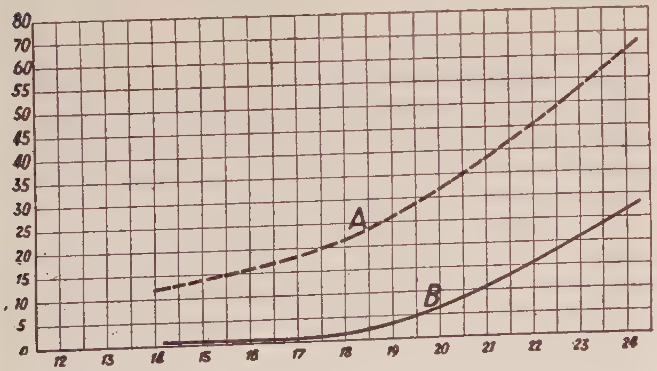

Figure 1. Showing production of two grades of fineness, in metric tons per hour. Ordinates (left side) represent percentages retained on sieves. Abscissas represent metric tons per hour. Curve A represents percentage retained on 4,900-mesh sieve, and Curve B the percentage retained on the 900-mesh sieve

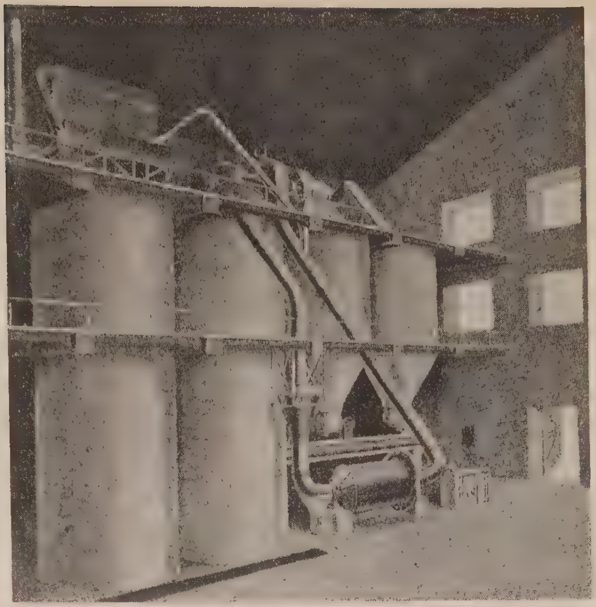

Figure 3. The raw-mill installation here described

Operation of the Installation

Figure 3 illustrates the raw mills concerned. The raw material is first pulverized in a moist state and conveyed by air into the mill. The air current is produced by a fan, which takes up the output of the raw mill and conducts it to an air separator. The latter sorts out the material which does not as yet have sufficient fineness, returning it to the raw mill by means of a screw conveyor, to be ground again. The air current enters immediately into the cyclone seen on the bin, which separates out the impalpable powder. Then the raw meal returns to the fan completely ground, thus completing a closed circuit. The impalpable powder drops into the bin and is subjected to the action of a special agitating apparatus, as a means of obtaining a more complete mixture to correct natural variations in the composition of the

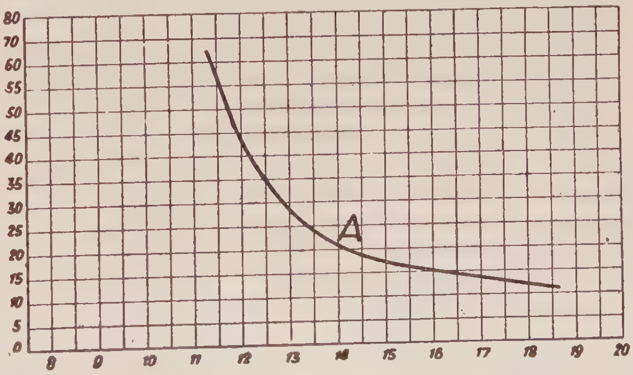

Figure 2. Power consumption of the installation in kw-hr. per metric ton of raw material, ground to different degrees of fineness. Ordinates show percentages of material retained on the 4,900-mesh sieve, as indicated by Curve A. Abscissas represent kw-hr. per metric ton

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[1] 4,900 meshes per sq. cm. correspond to 178 meshes per lin. in.

[2] 900 meshes per sq. cm. correspond to 76 meshes per lin. in.

raw material. The gas of combustion enters through the charging tubes of the raw mill.

Dust Recovered in Filter

With the view of eliminating the water vapor being produced, a part of the air in circulation is constantly being taken out by means of a fan and conducted to the open air after passing through a filter.

The entire installation operates under low pressure, which insures operation without loss of dust. The dust recovered in the air filter is all returned to the mill stream, so that no loss of material occurs.

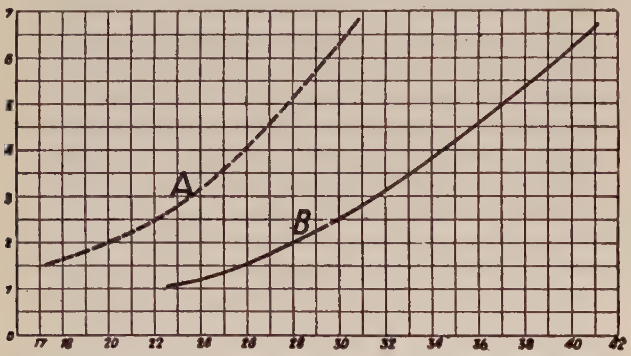

Figure 4. Curves showing outputs of a large-capacity cylindrical clinker mill, and a compound mill, in grinding of clinker from a rotary kiln. Ordinates (at left) show per cent retained on 4,900-mesh sieve. Abscissas show output in kilograms (about 2.2 lb.) per metric hp. utilized. Curve A represents output of compound mill, and Curve B the cylindrical mill

By means of the pneumatic conveyor, the usual conveying apparatus for transporting the raw meal to the bins is eliminated, as are also the special drying installations commonly employed, with their consumption of power and oil, their conveyors, and their costly construction.

Mill Occupies Little Space

The raw grinding installation here described occupies very little space, and it may be placed underneath the storage bins, thanks to the reduced height of the raw mill. For the same reason it is not necessary to have a large special building for this installation. An arrangement peculiarly simple and appropriate is the recovery of the dust by means of filters, which assures the cleanliness of the operation.

The drying of the material in its finished state makes possible the excellent results from the standpoint of quality and economy, assuring at the same time a high degree of fluidity of the raw meal when it is discharged from the bins. Another advantageous and agreeable result is seen in the easy and rapid regulation of the raw mill installation, thereby producing the fineness desired.

Designed Capacity Exceeded

The installation described above has been designed for an hourly output of 15 metric tons, but this capacity has been considerably bettered in actual operations.[3] The raw mill operates without interruption, and it represents a notable improvement and simplification in the preparation of raw materials.

The mill has, with equal success, accomplished the drying of raw materials of which the moisture content ranged as high as 6 per cent, without the necessity of supplying hot air to the operation. It should be observed that from the constant renewal of the large quantity of air in circulation, there has resulted a satisfactory grinding, although with a slightly reduced output and with the need of more ample air circulation. The moisture which the raw material retains after the operation may, however, give rise to some difficulties when the bins are emptied.

Performance in Grinding Clinker

Some equally interesting tests have been conducted with a large-capacity cylindrical mill for the grinding of clinker from rotary kilns and from vertical shaft kilns. One series of tests was made with clinkers of different categories. The results are shown in Figure 4. In order to compare the output of this mill with the outputs of compound mills with which the investigators were familiar, comparative experiments were made with a modern compound mill of the same diameter and with a clinker of the same category. These tests are shown in Curve *A*, Figure 4, while the tests of the cylindrical mill of greater output are represented by Curve *B*. These curves show clearly the advantages of the cylindrical mill of greater capacity.

Tests of the finished cement turned out by the two mills disclosed the same strength characteristics.

✦ PERSONALS ✦

L. W. Saxby, formerly purchasing agent, has been made assistant to the president of the Marquette Cement Manufacturing Company.

D. S. Colburn, formerly assistant to the president, has been made vice president of the Marquette Cement Manufacturing Company.

Robert H. Baker, former Tennessee Highway Commissioner, has been named sales manager in charge of the Chattanooga office of the Pennsylvania-Dixie Cement Corporation. His assistant sales managers are F. V. Clicquennoi, E. J. Head and H. Magrath.

Charles S. Marshall, 60, district manager for the Monarch Cement Co. for the past 13 years and long connected with the lumber and building material business in Omaha, died suddenly of a heart attack on May 5.

Edward D. Boyer, 77, of New York City, retired technical expert of the Universal-Atlas Portland Cement Company, died recently at Bound Brook, N. J.

Mr. Boyer was a past president of the American Concrete Institute.

C. A. Webb has been appointed sales manager of the Universal Atlas Cement Company, in charge of the Chicago metropolitan territory, *F. L. Stone*, vice president and general sales manager of the company announces.

Mr. Webb formerly was district sales manager for the company.

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[3] The actual hourly output given in the performance records near the beginning of this article is 38,250 lb. (17.1 metric tons, or 19.1 U. S. tons).

Measurement and Properties of Cinders and Fly-Ash

By **ARTHUR C. STERN**
Research Instructor on Smoke Abatement, Stevens Institute of Technology, Hoboken, N. J.

BECAUSE of agitation to set up legal limits for maximum permissible cinder and fly-ash emission, the Smoke Abatement Research Department of Stevens Institute started what has developed into a two-year study of available measurement methods for cinders and fly-ash. In order to give these measurement methods fair trial, numerous tests have been run under actual operating conditions, yielding data which have been correlated to present as complete as possible a picture of the properties and mechanism of production of cinders and fly-ash. The measurement methods investigated included filtration through cotton, woolen and asbestos bags of various sizes and shapes, through paper and alundum thimbles, through beds of granulated and pulverized sugar of various depths, and through asbestos wool; also, centrifugal separation in cyclone collectors of various sizes and proportions, electrical precipitation in precipitators of various dimensions using various potentials, and the Greenburg and Smith type of impinger. Of these, the impinger and the filtration methods, other than large bag filters, are of necessity low-sampling-rate methods. Of the low-sampling-rate methods, the author prefers the impinger (used with a make-up water bottle connected) to either of the thimble methods, which are in turn preferable to the sugar tubes or the asbestos-wool filter. However, a high-sampling-rate method is generally preferable to a low-sampling-rate method because of the increased accuracy of sampling the flue gas in the duct. A comparison of the three high-sampling-rate methods led to the selection of the cyclone method as being the most useful for all-around test work. In use its collection efficiency may be somewhat below that of the bag filter or electric precipitator, but the many operating advantages of this method more than compensate for the slightly lower efficiency. Subsequent experience proved the choice a sound one.

Metal Cyclone Types of Collectors

The dimensions of the cyclone collector developed as a result of these investigations were evolved by first studying the effect of changes in size, shape, and proportions of several glass cyclone models upon the streamlines in the models. As a result of these data, several satisfactory metal cyclones were built, using a small portable vacuum cleaner fan as aspirator and the pressure drop between the cyclone inlet and outlet as a flowmeter. The electric precipitator tubes used were built of two identical glass cylinders used in series so that the square of the ratio of the weight of the precipitate in the second tube to the weight of the precipitate in the first tube would be theoretically equal to one minus the efficiency of precipitation. These tubes were operated directly on alternating current, using luminous-tube transformers. When sampling flue gas with either of these methods, it is of course necessary to sample at the same velocity as the gas velocity in the duct and to apply appropriate corrections where this can not be done. Similarly, it is necessary to properly traverse the duct being studied by taking a large number of spot samples. With the cyclone, these spot samples are taken at the rate of about 100 cu. ft. of flue gas per minute for a duration of about 15 min.

In developing these test methods, five different boilers were tested for their boiler-outlet cinder and fly-ash loading. These boilers were fired in the following different manners: (a) Underfeed stokers with bituminous coal; (b) pulverized coal, vertically fired; (c) pulverized coal, tangentially fired; (d) chain-gate stoker with anthracite screenings; (e) chain-grate stoker with coke breeze. These boilers range in size from 7,000 to 110,000 sq. ft. of total heating surface and are all water-tube boilers.

Facts Determined

Cinders (particles blown over from stokers) are of course essentially different in character from fly-ash (the ash residue from burning pulverized coal). The boiler-outlet cinder-dust loading. expressed in grams per cubic foot of flue gas at 60 F. and 30 in. Hg., increases rapidly with increasing rate of burning coal expressed in pounds of coal per square foot of grate area per hour. Fly-ash dust loading, however, increases but little at higher rates of burning coal per unit furnace volume. By combining dust-loading data with coal and flue-gas analyses, it is possible to compute the weight of the dust as a per cent of the weight of the coal fired, the weight of the ash contents of the dust as a per cent of the weight of ash in the coal fired, and the per cent heat loss due to cinders and fly-ash expressed as a per cent of the heat in the coal fired. These percentages are more easily interpreted in terms of boiler operation than are dust loadings. Valuable data are obtained by studying the cinder and fly-ash samples, collected with the cyclone collector, for their particle-size distribution, their particle specific-gravity distribution, and the per cent of combustible matter in the particles. Size distribution may be expressed either as a size-frequency or a size-weight relationship, but the most useful data are obtained by a combination of both methods analyzed statistically. Boiler-outlet dust loadings are less than the furnace-outlet dust loadings by the quantity of dust retained by the boiler itself, particularly in hoppers at the bottom of passes in vertically baffled boilers. This quantity can be measured only by weighing the removals from these soot hoppers.

National Recovery Administrator Hugh S. Johnson approved on May 14 a uniform cost accounting system for the Cement Industry, as submitted by the Code Authority.

Abstract of paper for The American Society of Mechanical Engineers, 29 West 39th Street, New York, N. Y.

✦ EDITORIAL ✦

This Tariff Is No Protection

THE present duty of six cents per hundred pounds is wholly inadequate to enable the American cement industry to compete with foreign manufacturers in our own large coastal markets.

A large cement manufacturing company, in its annual report to stockholders, points out that the American cement industry is co-operating with the National administration by paying increased wages in accord with the spirit of the NRA; but this action places domestic manufacturers at a further disadvantage.

With the present low ratio of production to capacity, this country can not absorb any foreign cement without causing serious injury to the American cement industry.

Now that Congress has authorized the President to revise tariffs in connection with international trade agreements, the industry will doubtless bring the whole situation to his attention.

Cement Design

IN the cement and concrete industry the term "design" has been going places. Not many years ago, when the word was used in connection with concrete, its significance was largely structural. In the first bulletin of the Structural Material Research Laboratory, published in 1919 and entitled "Design of Concrete Mixtures," the term was applied to the making of concrete.

Recently the expression "cement design" has sprung up, apparently independently, from several sources—and it is an excellent addition to the industry's terminology. Just as stresses, section moduli, and deflections must be taken into account in designing a concrete structure, so is the proper proportioning of a concrete mixture essential to good work, and so also is the right kind of cement, to begin with. Since nearly all the materials of construction are synthetic, it is fitting that the new application of the word "design" should make its appearance.

Cement is no longer considered as a single substance—such as brick and building stone—but as a blend of the four principal clinker minerals. Information on simple procedures for calculating the approximate percentages of these minerals in portland cement has been broadcasted. Although they are not manufactured and marketed separately, the characteristics of each are becoming well known to cement users, through a series of published papers and reports before technical societies during the last few years. Among these characteristics may be mentioned early strength, later strength, volume changes in air and water, resistance to sulphates, resistance to freezing and thawing, and heat generation. While our methods for calculating the percentages of clinker minerals involve a number of assumptions and are to some extent empirical, they give an approximation of constitution through which some important developments have come about.

It is obvious that in designing an important structure the design of the cement itself is the proper place to start. In other words, this is a factor that should not be neglected. With other factors equal, the better the cement is suited for the project the better the results that may be expected. Of course, it is equaly true that engineering skill can do much to compensate for any advantages possessed by a cement manufactured for a special purpose.

In the whole matter the cost of producing cement must be taken into account. Of all the substances produced in multi-stage processes, portland cement is marketed at one of the lowest prices per ton. This price has been one of the important factors in developing the myriad uses of the material. Diversification inevitably will be accompanied by increased costs of production. Naturally, the various factors will reach equilibrium in time, just as has been the case with other industrial developments.

Accident-Prevention Is Slipping

SOMETHING is slipping in the department of accident-prevention in the cement industry—the industry that has won nation-wide admiration and respect for its leadership in this great forward movement in industrial progress.

In an editorial on this page in the May issue, mention was made of the fact that the year 1933 saw a reversal of the downward trend in the number of blasting-cap accidents in and around quarries. That unsavory record provides another indication that interest in accident-prevention is slipping.

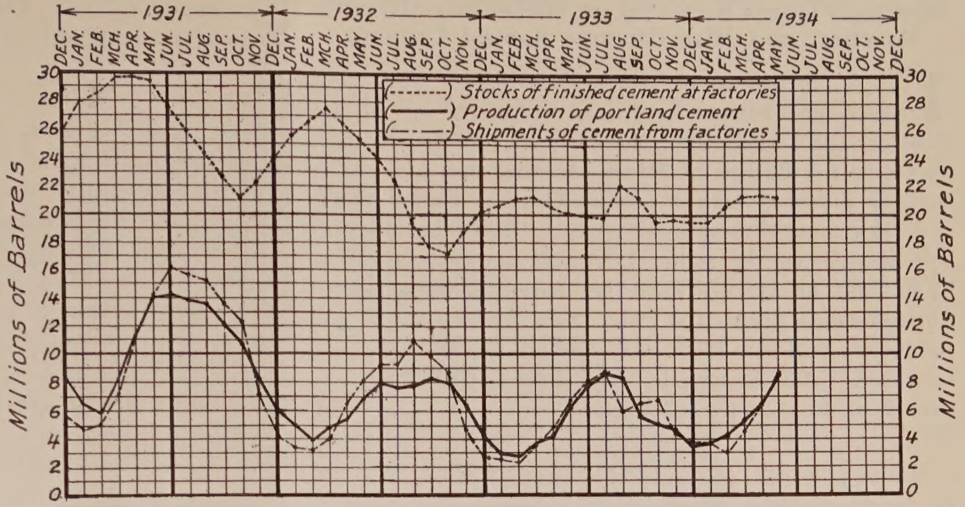
Considering the cement industry as a whole, the year 1934 has made a very poor showing thus far. Unless there is a distinct improvement in the second half of the year, 1934 will go on record not only as a very poor accident-prevention year, but also as the first year to show a serious reversal in ten years.

Possibly some cement company executives have been acting on the mistaken theory that, once the goal is reached, the industry will maintain its low-accident record without the necessity of special effort. There may be others who thought accident-prevention would be a good place to "cut expenses."

Both groups are wrong. Only sustained vigilance will hold accidents at a low level.

Cement Statistics for May

PRODUCTION of portland cement in May, 1934, showed an increase of 36.6 per cent and shipments an increase of 30.1 per cent, as compared with May, 1933. Portland cement stocks at mills were 6.1 per cent higher than a year ago.



Relation of Production to Capacity (Per Cent)

	The Month	Twelve Months
May, 1934	37.5	26.7
May, 1933	27.4	26.0
April, 1934	29.6	25.9
March, 1934	23.0	25.0
February, 1934	20.2	24.4

Production, Shipments and Stocks of Finished Portland Cement (Barrels)

	1933	1934
Production, May	6,262,000	8,554,000
Shipments, May	6,709,000	8,731,000
Stocks at end of month	20,117,000	21,345,000
Production for year to date	19,864,000	28,302,000
Shipments for year to date	19,948,000	26,571,000

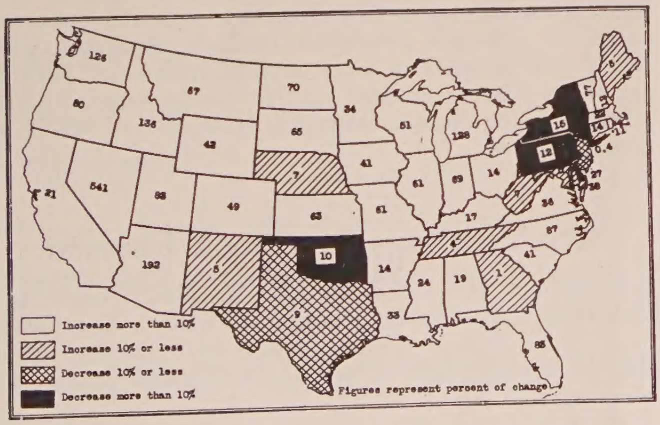
In this statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 163 plants at the close of May, 1934, and of 164 plants at the close of May, 1933.

Black Areas Disappearing from Cement Map

Forty-Two States Report Increase in Cement Shipments Compared with Year Ago

FORTY-TWO states experienced an increase in shipments of portland cement during the 6-month period ending April 30, 1934, as compared with the corresponding period of the year before.

Of the six states that reported a decrease, four experienced a decrease of 10 per cent or more, while in two states the decrease was less than 10 per cent. In the 42 states showing increased shipments, these increases ranged from 1 to 541 per cent.



The improved situation with respect to cement shipments may be seen in the following tabulation of 6-month periods, in which a comparison is made with similar periods ending a year earlier.

	Number of states	
Period considered	Showing decrease	Showing increase
6-month period ending Jan. 31, 1934	34	14
6-month period ending March 31, 1934	17	31
6-month period ending April 30, 1934	6	42

Because of the length of the period considered, temporary influences are largely eliminated. The trend shown is extremely encouraging to the industry.

Change of Name

EFFECTIVE June 15th, the name "Compania de Cemento Portland 'Landa' S. A." was changed to "Cementos Atoyac, S. A."

The officers of the new company continue: F. J. Miller, president and general manager; Alton J. Blank, general superintendent and supervising chemist; John A. Blank, consulting chemist; A. P. Hughes, chief accountant; W. Jenkins, chief clerk.

International Shows Profit

THE fifty-fifth quarterly report of the International Cement Corporation, New York City, covering the first quarter of 1934, shows a net profit of $49,896.45 as compared with a loss of $180,857.64 for the first quarter of 1933.

The report is signed by Charles L. Hogan, President.

Production of Special Cements in 1932 and 1933

Separate Figures Reported on High-Early-Strength, Masonry, and Miscellaneous Special Cements

THE U. S. Bureau of Mines, Washington, D. C., has issued preliminary figures on output of special cements in the United States in 1933, as reported by producers to the Bureau of Mines, showing that high-early-strength portland cement produced in the United States in 1933 amounted to approximately 1,072,000 barrels, and shipments from the mills, 1,096,000 barrels, valued at $2,193,000, an average value per barrel of about $2.00. Corresponding figures for 1932, from final reports of the producers, follow: High-early-strength portland cement produced, 1,287,586 barrels; shipments, 1,105,191 barrels, valued at $1,915,215, an average value per barrel of $1.73.

Masonry cement, of the portland cement class, reported produced in 1933 amounted to approximately 386,000 barrels; shipments from mills, 395,000 barrels, valued at $535,000, an average value per barrel of about $1.35. Corresponding figures for 1932, from final reports of the producers, follow: Masonry cement produced, 433,332 barrels; shipments 442,038 barrels, valued at $581,255, an average value per barrel of $1.31.

Miscellaneous special cements (including so-called "oil-well" and "high-silica" portland cements and cement manufactured under the trade name "Super") produced in 1933 amounted to approximately 807,000 barrels; shipments, 754,000 barrels, valued at $1,314,000, an average value per barrel of about $1.74. Corresponding figures for 1932, from final reports of the producers, follow: Miscellaneous cement produced, 413,644 barrels; shipments, 340,494 barrels, valued at $577,175, an average value per barrel of $1.70.

Code Authority Proposes Exemptions

Suggest Advice and Consultation as Proper Service to Purchaser of Cement

ACTING Division Administrator Barton W. Murray has under advisement the request of the code authority for the cement industry, proposing exemption of the members of the industry from Article 10, Section 4, Subsection *k*, and Article 13, Section 3 of the code. If granted, the exemption would apply only to bids by members of the industry for portland cement for Fort Peck Tunnels in Montana.

The code authority proposed the adoption of two clauses, reading as follows:

"Services to purchasers or users are proper under fair competition, if confined within the limits of advice and consultation. The furnishing of articles or facilities of a definite physical nature, whether by way of loan, lease, gift, or otherwise, resulting in monetary benefit to purchasers or users is discriminatory and shall constitute unfair competition.

"No member of the industry shall pay or absorb, directly or indirectly, any charges for inspection or tests made by or on behalf of the purchaser to determine compliance with specifications therefor."

While, as stated, the proposed exemption would apply only to bids for cement for the Montana project, the decision in this case will have a bearing on future questions of a similar nature. The time limit for filing objections, criticisms or suggestions expired on June 30.

Persia's First Cement Plant

THE industrial program of Persia has advanced a step with the recent opening of the first cement factory in that country, according to a report from Consul Robert B. Streeper, Teheran, made public by the Commerce Department. The plant, located about five miles from Teheran, cost approximately $900,000.

The new plant was built by a Danish construction company and took 18 months to complete. After being operated for ten days at 80 per cent capacity it was turned over to the Persian government.

Raw materials for the operation of the plant, the report points out, are obtained from the immediate vicinity. It is estimated that the factory will be able to obtain required limestone and clay within a distance of one mile. The total capacity of the plant is 100 metric tons of cement per day.

The cement produced by the new factory is said to answer the specifications of a medium quality portland cement. It is understood that the proper part of the output will be used in railway construction work, and should there be a surplus the government plans to utilize it for paving the streets of Teheran and other large cities throughout the country.—*Washington, D. C., Post.*

New Books and Pamphlets

Insulation in Lime and Cement Industries

INSULATION IN LIME AND CEMENT INDUSTRIES is the title of a new publication, 48 pages, 8½ by 11 in., issued by Johns-Manville, New York.

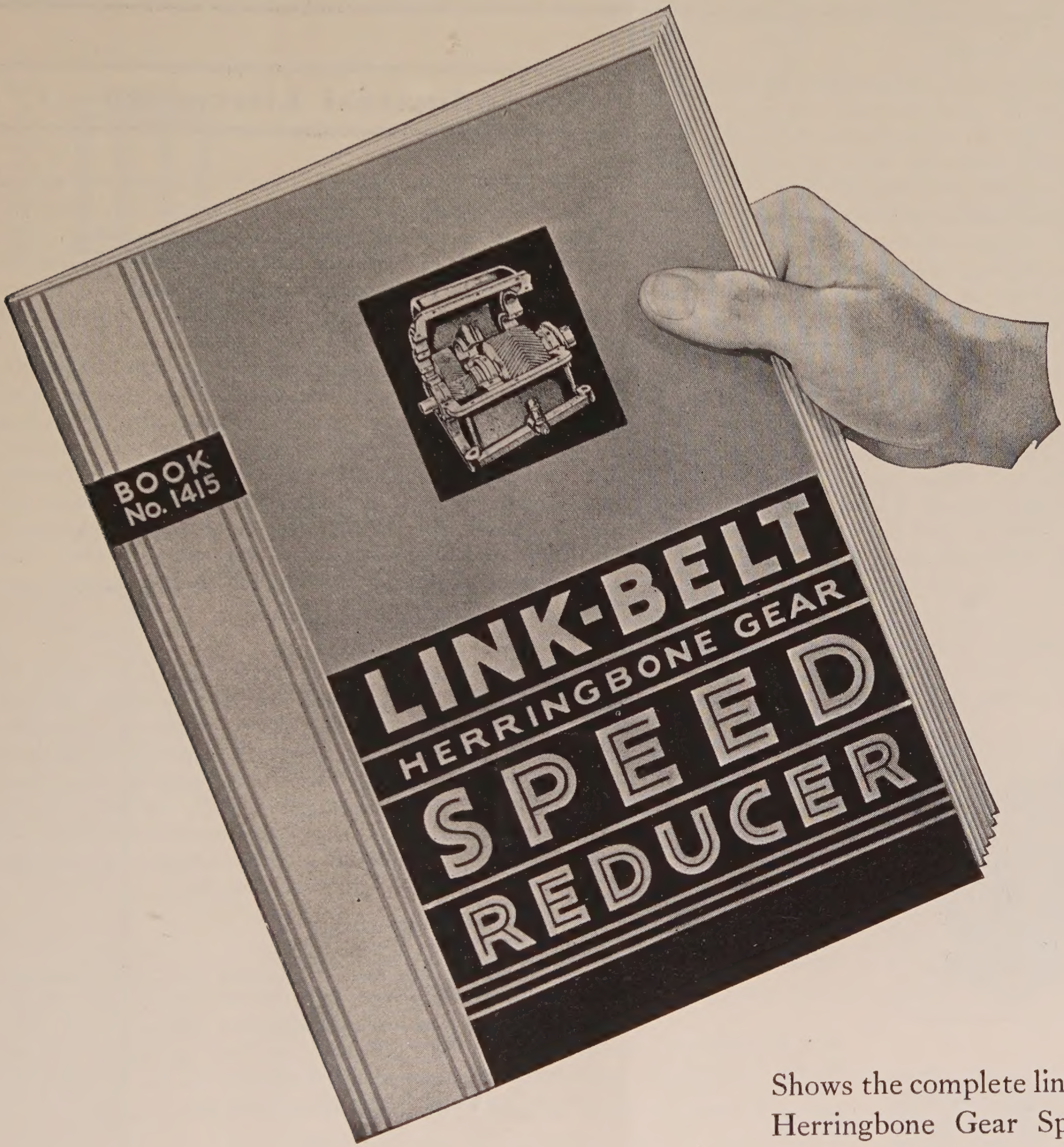
While this book is a manufacturer's catalog, in one sense, it contains much data of value to cement plant engineers. It describes insulation methods employed with rotary cement and lime kilns, vertical lime kilns, settling chambers, waste heat flues, boilers, piping and auxiliary power plant equipment. Detailed drawings and specifications are given.

Arc Welding Handbook Revised

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE. Published by The Lincoln Electric Co., Cleveland, Ohio. Second edition, revised and enlarged. Flexible cover, 450 pages. Price $1.50. Foreign postage 50 cents extra.

The first edition of this handbook, reviewed on page 34 of the November (1933) Cement Mill Edition of CONCRETE, was quickly exhausted. The new volume contains eight principal sections dealing with various phases of arc welding. There are several hundred illustrations, including halftones and detailed line drawings.

Send for this NEW Book



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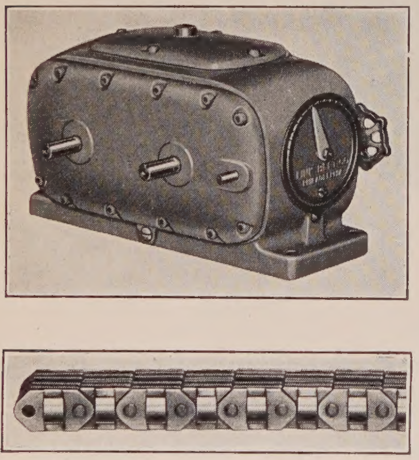
MILL EQUIPMENT

THE rotary Fluxo Packer is a patented machine designed for the automatic packing and weighing of cement, ground lime, ground phosphates, soda ash, and similarly finely ground materials into valve bags. The Packer consists of a cylindrical supply tank on which filling spouts with associated weighing mechanisms are mounted. This tank rotates slowly about its axis, the makers say, and the starting and the interrupting of the flow of cement to the bags, as well as the discharge of the filled bags, are entirely automatic. The duty of the attendant is merely to slip a bag on each filling spout as they pass him. The accuracy of weighing is said to be great and cannot be interfered with by the attendant since the filled bags are discharged before they reach him.

The rotary Fluxo Packer is furnished in various sizes with varying numbers of filling spouts, in accordance with the packing capacity desired. Packers with 12 spouts, it is said, can pack 1,500 to 1,600 bags of standard portland cement per hour with only one man in attendance.

●

A NOVEL self-adjusting, positive variable speed transmission for fractional horsepower duty, known as the Link-Belt V.R.D. (Variable Roller Drive), is announced by Link-Belt Company, Chicago, as a companion to their P.I.V. Gear variable speed transmission announced about 5 years ago for larger capacities.



New Link-Belt V. R. D. horizontal type transmission and a section of Link-Belt V. R. D. chain

●

MIAG Braunschweig Calcinator is described in a new catalog being distributed by the Bradley Pulverizer Co., New York City, sole agents for the United States, Canada and Mexico.

The calcinator was designed with the idea of creating a machine which could be fitted without great alterations to existing rotary kiln plants, with the endeavor to obtain with the wet process similar results as regards output and fuel consumption as are produced with the dry process.

◆ Manufacturers' News ◆

Wm. E. Umstattd was elected president of The Timken Roller Bearing Company on June 16 to succeed H. H. Timken, resigned. Mr. Timken remains as chairman of the board.

◆ Industrial Literature ◆

BENTONITE is the title of a handbook recently revised by the Silica Products Company of Kansas City, Missouri.

This book covers the properties, sources, geology, production and uses of Bentonite and is written to inform the user on the general properties of this material.

Bentonite has been used for the following purposes or products:

Portland, quick hardening, natural, gypsum, magnesia, masonry, and bricklayers' cements; mortar; stucco; concrete plaster; artificial stone; cement tile; building blocks; sewer pipe; poles; posts; waterproof concrete; slag cement; pozzuolanic cement; glauconite cement; concrete surface cures and washers; plastic mixtures for pottery; glazes, clay brick; tile; light-weight aggregate; insulators; porcelain; refractory cement; fire clay; fire brick; insulation blocks; binder and sealing agent.

●

DUST-HAZARDS and their prevention is a series of monthly folders being issued by the Northern Blower Co., Cleveland, Ohio. The data, whenever possible, will consist of Government reports, reprints of authoritative articles from leading trade papers, tests and information from the company's own records. It is planned to make the series a valuable record which will assist executives in eliminating the dangers of occupational sickness, and of fire, explosion, etc.

●

AMSCO Alloy for heat, corrosion and acid resistant applications is described in a recent folder as a time-tested series of cast nickel-chromium alloys. This alloy is available in six different analyses according to the American Manganese Steel Company of St. Louis, producers of light and heavy alloy castings.

●

THE Brown Electric Flow Meter is briefly described in a recent folder issued by the Brown Instrument Co., Philadelphia. The Flow Meter records the rate of flow and checks steam distribution over periods of time. It measures total steam used, department steam costs and process operation.

●

TIMKEN rock bits—on and off in a jiffy—are described in a recent folder distributed by the Timken Roller Bearing Company, Canton, Ohio. The company claims it is cheaper to throw away a used Timken bit than to resharpen an ordinary steel.

●

BULK Handling by Belt has just been published by the Chain Belt Company of Milwaukee. The folder shows applications of Rex-Stearns Timken idlers in industries handling bulk material—sand and gravel, rock, coal, coke and ore.